IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:		)
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Inventors:	Guy Eden	)
		)
Serial No.:	09/859,660	) ATTORNEY FILE NO.
		) SLA1014
Filed:	May 16, 2001	)
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Title:	SYSTEM AND METHOD FOR DISCOVERING NETWORK COMPONENTS	) Examiner: Ramsey Refai
		) Confirmation No.: 3934
		) Art Unit: 2152

Board of Patent Appeals and Interferences
United States Patent and Trademark Office
P.O. Box 1450
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BRIEF ON APPEAL

This is an appeal from the rejection by Examiner Ramsey Refai, Group Art Unit 2154, of claims 1-6, 8-20, and 22-26 as set forth in the CLAIMS APPENDIX, all claims in the application.

REAL PARTY IN INTEREST

The real party in interest is Sharp Laboratories of America, Inc., as assignee of the present application by an Assignment in the United States Patent Office on August 11, 2001, with a recordation date of May 16, 2001 at Reel 011840, Frame 0401.

RELATED APPEALS AND INTERFERENCES

None.

STATUS OF THE CLAIMS

Claims 1-6, 8-20, and 22-26 are in the application.

Claims 1-6, 8-20, and 22-26 are rejected.

Claims 1-6, 8-20, and 22-26 are appealed.

STATUS OF AMENDMENTS

Section 1 of the Final Office Action objected to claims 15 and 24. The Applicant made a good faith effort to amend the claims in a response under 37 CFR 1.116, received at the PTO on April 18, 2006. Line 9 of claim 15 recites the phrase "to5", which the Applicant attempted to amend to the phrase "to". Line 3 of claim 24 recites the phase "a the", which the Applicant attempted to amend to the phase "the". An Advisory Action mailed on June 19 stated that the Applicant's response was found to be noncompliant. Therefore, these amendments have not been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

The problem addressed by the present invention is presented in the specification at page 1, line 11, through page 3, line 12 (see the

specification enclosed in EVIDENCE APPENDIX, ATTACHMENT A). Generally, the problem is associated with network discovery. Upon initialization, a querying device (i.e., a personal computer) conventionally checks its list of network-connected components (e.g., a printer) by attempting to communicate with every device on the list. Once the list has been checked, the querying device builds a graphical user interface (GUI) to show a user the connected devices actually available (see Fig. 1, EVIDENCE APPENDIX, ATTACHMENT B). The problem occurs when a device is no longer connected to the network, or is turned off. Then, the querying device can wait for as long as 30 seconds for a response from a single device. If no response is received, and a timeout occurs, the GUI indicates that the device is not connected (see Fig. 2). However, a conventional GUI does not create a display, which indicates device availability, until all the device queries have been resolved.

The Applicant's solution to the problem is simple. Rather than waiting for all the devices to reply, the querying device first builds a GUI representation of network-connected devices, see the timing diagram of Fig. 8. Then, as devices either respond or timeouts occur, the GUI representation (availability) of a device is modified. A process for querying network-connected devices to determine availability (claim 1) is described at page 15, ln. 9, through page 16, ln. 12. In its broadest form, Step 1304 builds a GUI representation of network-connected device availability. Then, Step 1306 begins querying devices. As described in dependent claims, Step 1305 shows that the devices may initially be represented in the GUI as unavailable. If a reply is received (Step 1308), the GUI is revised to show the device as available. If a timeout occurs (Step 1312), the device unavailable status is maintained (Step 1314). The

device status initially represented in the GUI is arbitrary, since the GUI is updated with actual values once the query process is completed.

A method for building a GUI that represents device availability, independent of system timeouts (claim 13), is described at page 17, ln. 24, through page 18, ln. 9 (see Fig, 14). Step 1402 builds a GUI representing network-connected devices. Step 1404 initially represents devices as unavailable. Step 1406 modifies the GUI representation to show a device as available in response to receiving a communication from that device. The invention is recited from a systems/device perspective in claim 15, which is described at page 7, ln. 7, through page 8, ln. 2 (see Fig. 3).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether claims 1-6, 8-20, and 22-26 are indefinite under 35 U.S.C. 112, second paragraph, for failing to particularly point out and claim the subject matter of the invention.

2. Whether claims 1-5, 12-19, and 25 are anticipated under 35 U.S.C. 102(e) by Carcerano et al. (US 6,308,205).

3. Whether claims 6, 8-11, 20, 22-24, and 26 are unpatentable under U.S.C. 103(a) over Carcerano et al. in view of admitted prior art (AAPA).

ARGUMENT

1. The rejection of claims 1-6, 8-20, and 22-26 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to

particularly point out and claim the subject matter of the invention.

Claim 13: The Final Office Action states that claim 13 has been rejected because of the recited term "network-connected device". The Office Action states that "(i)t is not clear if this device is a device from the group of "the network-connected devices" previously introduced in the preamble."

In addition to appearing in the preamble, the phrase "network-connected devices" appears in the first step of the claim, which recites "...building a GUI representation of network-connected devices..." Therefore, the issue to be resolved should be whether ambiguity exists between the step of "building the GUI representation of network-connected devices" and the step of "sending a query to a network-connected device".

Claim 13 can be summarized into three steps, which are:

building a GUI representation of network-connected devices;

sending a query to a network-connected device; and,

modifying the GUI representation of the network-connected device in response to sending the query.

Even if it is possible to imagine some ambiguity between "the network-connected device" in the second step, and "the network-connected devices" in the first step, this ambiguity would be resolved in the third step, in which the representation of "the network-connected device" is modified. Since the GIU representation of "the network-connected device" is modified, it must necessary be one of the GUI-represented "network-connected devices" in the first step.

Claim 15: The Final Office Action states that the term "at least one device" is indefinite because it is not clear to what this term is referring. Claim 15 is an independent claim reciting two basic network-connected elements: "a querying device", and "at least one device having a network connection port for communicating with the querying device". Thus, the claim clearly states that the "at least one device" is a device that is communicating with the querying device.

Claims 18-26: The Final Office Action states that it is not clear whether "a first network-connected device" and "a second-network-connected device" are from among "the network-connected devices" previously recited.

This rejection is clearly addressed by simply reading the claims. Claim 18 recites the steps of sending a query to "each of the network-connected devices" and "receiving a query reply from a first network-connected device". It is clear and unambiguous that the first network-connected device is a device that responds to the query sent to "each of the network-connected devices". Likewise, in claim 19, it is clear that the second network-connected device is a network-connected device that does not respond to a query.

Antecedent Basis: In claim 1, the Office Action states that there is no antecedent basis for the terms "network-connected devices", "the GUI", and "the queries". With respect to the term "network-connected device", the Applicant does not understand the rejection. The term is used many times throughout claim 1, and claims dependent from claim 1. The term is initially introduced in line 5 of claim 1.

With respect to the term "the GUI" (in line 7), the term "GUI representation" is initially introduced in lines 4 and 5. The Applicant

respectfully submits that an expert reading claim 1 would find no ambiguity between the terms "building a GUI representation" in Step 1, and "following the building of the GUI" in Step 2.

With respect to the term "the queries" (in line 9), the phase "sending a query...to the network-connected devices" is initially introduced in line 6 of claim 1. The Applicant submits that an expert would find no ambiguity between "sending a query ...to...devices" and "the queries".

The Office Action states that there is no antecedent basis for the term "the GUI" in claims 2, 3, 12. As noted above, the term "building a GUI representation" is initially introduced in lines 4 and 5 of claim 1. Further, the phrase "following the building of the GUI" is presented on line 7 of claim 1.

The Office Action states that there is no antecedent basis for the term "the GUI representation" in claims 9 and 15. As noted above, the term "building a GUI representation" is initially introduced in lines 4 and 5 of claim 1.

The Office Action states that there is no antecedent basis for the terms "updating the GUI representation" in claims 4 and 5. The term "updating the GUI representation" is initially introduced in line 9 of claim 1.

The Office Action states that there is no antecedent basis for the term "changing the GUI representation of the first network-connected device" in claims 4 and 9. The term "updating the GUI representation" is initially introduced in line 9 of claim 1. The first network-connected device is initially introduced in claim 4. Claim 4 further limits the step of "updating the GUI representation", initially presented in claim 1, as

"changing the GUI representation of the first network-connected device". Alternately stated, this is the initial presentation of the substep of "changing the GUI representation of the first network-connected device".

The Office Action states that there is no antecedent basis for the term "the GUI representation of the second network-connected device" in claims 5 and 10. The term "updating the GUI representation" is initially introduced in line 9 of claim 1. The second network-connected device is initially introduced in claim 5. Claim 5 further limits the step of "updating the GUI representation", initially presented in claim 1, as "maintaining the GUI representation of the second network-connected device". Alternately stated, this is the initial presentation of the substep of "maintaining the GUI representation of the second network-connected device".

In claim 13, the Office Action states that there is no antecedent basis for the term "the network-connected devices" and "the GUI representation of the network-connected device". The term "network-connected devices" is initially introduced in line 6 of claim 13. The term "building a GUI representation" is initially introduced in lines 5 and 6.

In claim 14, the Office Action states that there is no antecedent basis for the term "modifying the GUI representation". In response, the Applicant notes that the term is initially presented in claim 13, line 9.

In claim 15, the Office Action states that there is no antecedent basis for the terms "network-connected devices" and "the GUI representation". The term "network-connected devices" is initially introduced in line 4 of claim 15, and the term "a GUI representing network-connected devices" in introduced in lines 3 and 4. The Applicant

respectfully submits that an expert in the art would be able to identify "a GUI representing network-connected devices" as "the GUI representation of network-connected devices.

In claim 18, the Office Action states that there is no antecedent basis for the term "the GUI representation of the first network-connected device". The first network-connected device is initially introduced in claim 18. Claim 18 further limits the querying device's GUI representation of network-connected devices (first introduced in claim 15) by reciting that the GUI representation of the first device is changed to "available", as a result of the first device responding to a query.

In claim 20, the Office Action states that there is no antecedent basis for the term "the GUI representation of the second network-connected device". The second network-connected device is initially introduced in claim 19. Claim 20 (dependent from claim 19) further limits the querying device's GUI representation of network-connected devices (first introduced in claim 15) by reciting that the querying device "maintains the GUI representation of the second device as unavailable", in response to the second device not responding to a query.

In claim 23, the Office Action states that there is no antecedent basis for the term "the querying device GUI" and "the representation of the first network-connected device". In response, the Applicant notes that claim 15 introduces the claim element of "a query device having a GUI representing network-connected devices". The Applicant submits that an expert in the art would not find any ambiguity between the term "the querying device GUI" and the querying device initially recited in claim 15. The term "GUI representation of the first

network-connected device" is initially presented in claim 18, from which claim 23 depends.

In claim 24, the Office Action states that there is no antecedent basis for the term "a query reply", "the querying device GUI", and "the representation of the second network-connected device". In response, the Applicant does not understand how there can be an antecedent basis problem with the initial introduction of a phase prefaced with the article "a" (a query reply). Alternately stated, this is the initial introduction of a False answer received in response to a query reply.

The Applicant submits that an expert in the art would not find any ambiguity between the term "the querying device GUI" and the querying device initially recited in claim 15. Claim 19 recites "the GUI representation of the second network-connected device as unavailable". The Applicant submits that an expert would not find ambiguity between claim 19 and the term "the representation of the second network-connected device as unavailable" recited in claim 24.

The above-mentioned antecedent rejections appear to be spurious, pedantic, contradictory, and oblivious to the manner by which broad limitations in the base claim are further limited in the dependent claims. As support for this assertion, page 4 of the Office Action states that there is a difference between the limitations of "building a GUI representation of network-connected devices" and "building a GUI representing network-connected devices". The Office Action states that since claim 1 describes "building a GUI representation", any dependent claims that recite "building a GUI" are indefinite since a GUI has not been claimed. This analysis is incorrect on a number of levels.

First, 35 U.S.C. 112, second paragraph, states that the specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as the invention. The Applicant respectfully submits that a person skilled in the art would not find a contradiction between the terms "building a GUI representation" and "building a GUI".

Second, antecedent basis refers to the issue of ambiguity in the recitation of related claim elements. Neither 35 U.S.C. nor the MPEP equate definiteness with the rigid use of exactly the same word endings or exactly the same word order. "(T)he failure to provide explicit antecedent basis for terms does not always render a claim indefinite. If the scope of a claim would be reasonable ascertainable by those skilled in the art, then the claim is not indefinite. *Ex parte Porter*, 25 USPQ2d 1144, 1145 (Bd. Pat. App. & Inter. 1992).

We have held that a claim is not indefinite merely because it poses a difficult issue of claim construction; if the claim is subject to construction, i.e., it is not insolubly ambiguous, it is not invalid for indefiniteness. *Honeywell Int'l, Inc. v. Int'l Trade Comm'n*, 341 F.3d 1332, 1338-39 (Fed. Cir. 2003), see Evidence Appendix, Attachment D. That is, if the meaning of the claim is discernible, "even though the task may be formidable and the conclusion may be one over which reasonable persons will disagree, we have held the claim sufficiently clear to avoid invalidity on indefiniteness grounds." *Exxon Research & Eng'g Co. v. United States*, 265 F.3d 1371, 1375 (Fed. Cir. 2001), see Evidence Appendix, Attachment E.

Third, several of the so-called antecedent problems refer to dependent claims where elements broadly claimed in the base claim are

further limited in dependent claims. For example, a *first* network-connected device is introduced as an example of a network-connected device that responds to a query, and its GUI representation is further refined to recite that the GUI representation is changed from "unavailable" to "available" (e.g., claims 4 and 18).

2. The rejection of claims 1-5, 12-19, and 25 as anticipated under 35 U.S.C. 102(e) by Carcerano et al. (US 6,308,205).

Section 4 of the Office Action states that claims 1-5, 12-19, and 25 have been rejected under 35 U.S.C. 102(e) as anticipated by Carcerano et al. ("Carcerano"; US 6,308,205). With respect to claims 1 and 15, The Office Action states that Carcerano describes building a GUI representing available devices, and querying devices after building the GUI.

At col. 2, ln. 46-54, Carcerano describes a web browser that sends a request to network device. At col. 11, ln. 38-51, Carcerano describes a browser-based network management system that sends URL-encoded requests to obtain and monitor the status of network devices. At col. 14, ln. 47-67, Carcerano describes Steps 811 and 812 of Fig. 8B. These steps describe receiving a HTTP response and receiving configuration data. The above-mentioned passages are cited in the Office Action as evidence that Carcerano describes the building of a GUI prior to sending queries to network-connected devices.

In the ***Response to Arguments*** Section, on page 9, the Office Action states that Carcerano builds a browser interface prior to sending device status inquiries. More specifically, the Office Action states

that Carcerano teaches that the data to fill a template, which is used to construct the interface, is obtained from a database, citing col. 2, ln. 46-54, col. 11, ln. 38-51, and col. 14, ln. 47-67.

Generally, the Office Action appears to be merging the step of sending of queries from users, to a database of device configuration information, with the separate step of sending queries by the database to the network-connected devices, to collect the device configuration data.

Col. 2, ln. 35-54 states:

> Accordingly, in one aspect, the invention is a system that allows a remote network user to view and update a configuration of at least one of a plurality of network devices connected to a network, by using a web browser on the user's workstation. The system repeatedly polls each of the network devices over the network for configuration information. The configuration information is stored in a database. A first URL-encoded request is received from a user's workstation, preferably using a standard web browser communicating using HTTP. The first request identifies a targeted one of the network devices, together with a request for the targeted device's configuration. Responsive to the first request, a response corresponding to the requested configuration is generated dynamically from the database, with the response preferably being in a format representative of a visual display of configuration information for the targeted network device. The response is preferably dynamically-generated HTML code based at least in part on the configuration information stored in the database and on a template.

In summary, the above-quoted section from the Carcerano disclosure describes a system that repeatedly polls network devices for configuration data. This information is stored in a database on a template. This passage also describes supplying device configuration data from the database, as a visual display, to requesting users. However, the passage does not describe a GUI or visual display depicting all the devices

in the network. The user merely receives a visual display for a particular requested device. More important, the passage does not describe a database, or GUI representation of a database, that is built prior to sending a query to a device. First, the passage clearly states that the template in the database is only filled after "repeatedly polling" a device. Second, user queries are not sent to, or answered by the device itself, they are answered by the database. Therefore, regardless of whether Carcerano is viewed from the perspective of a user making inquiries to the database, or the database making inquiries to the network-connected devices, Carcerano does not describe a GUI representation (or even a database) that is built before sending queries to the network devices.

Col. 11. ln. 38-51 states:

> Browser-based network management system 109 communicates with a requesting station such as workstation 70 using HTTP. In order to obtain and monitor status and configuration of a managed device (or the network interface device for that managed device), browser 83 on workstation 70 sends a URL-encoded request for status or configuration information about a managed network device on network 1. In response, HTTP server 103 accesses the CGI script identified in the URL-encoded request so as to dynamically generate a response representative of a visual display of the status and configuration. This response is generated by filling in one of templates 107 with data from database 105. The response is communicated to browser 83, which displays the visual display.

This passage is similar to the section cited from col. 2. A user's browser 83 sends a request for status or configuration data about a device. A server 103 accesses a script from an already filled template. The response is displayed on browser 83. Once again, this section merely describes the accessing of a database. At this point in Carcerano's

process, the database has already completed its device inquiries, which result in the database templates being filled.

Col. 14, ln. 47-67 states:

> If such a URL-encoded request has been received, flow proceeds to step S811, where HTTP server 103 dynamically generates a response, preferably in the form of HTML code. This HTML code is generated by accessing the CGI script (or ASP web page) identified by the URL. Then, HTTP server 103 generates the HTML code based on the CGI script (or ASP web page) and the entries in database 105 for the device identified in the URL-encoded request. In the case of a CGI script, HTTP server 103 executes that script, which accesses one of templates 107 in dependence on the nature of the request and accesses database 105 so as to complete the template. Then, the HTML code for the completed template is returned to browser 83 through HTTP server 103.
>
> In step S812, it is determined if HTTP server 103 has received a URL-encoded request from browser 83 with an update to configuration data. If such a URL-encoded request has been received, flow proceeds to step S813, where a CGI script identified by the request is executed so as to update database 105 with the updated configuration data. This update is placed in a queue in the database so that the process of FIG. 8A can identify the change.

Again, this cited passage is similar to the passages from Carcerano already quoted. As in the passage of col. 11, the above-described process describes occurrences that take place after the database makes device inquiries, and fills the templates as a result of these inquiries. The scripts are dynamically supplied to users as a visual display, by the database, when a user requests configuration data for a particular device.

Support for the Applicant's position can also be found in Carcerano's Fig. 8A. The first step of Fig. 8A (Step S801) describes

"discover devices". Step S802 describes "poll network devices". Step S803 describes "store configuration information in database". At col. 13, ln. 58-65, Carcerano describes the use of conventional SNMP or DMI protocol to perform discovery (Step S801). Alternately stated, Carcerano begins his process with a conventional device discovery operation. A conventional discovery operation is described in the Background Section of the Applicant's specification (Evidence Appendix Attachment A, pages 1-3. The Applicant's claims are a solution to the time-out problem associated with conventional device discovery.

Claims 1, 13, and 15 of the claimed invention describe initially building a GUI representation of network-connected devices. Only after building the GUI does the querying device send a query to network-connected devices. Carcerano does not disclose a database that is built prior to making device inquiries. Therefore, Carcerano cannot disclose a visual representation of network-connected devices that is built prior to sending device status inquiries.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Carcerano does not explicitly describe every limitation of claims 1, 13, and 15. Since Carcerano does not describe every limitation of the claimed invention, he cannot anticipate. Claims 2-5 and 12, dependent from claim 1, claim 14, dependent from claim 13, and claims 16-19 and 25, dependent from claim 15, enjoy the same distinctions from the Carcerano reference.

3. The rejection of claims 6, 8-11, 20, 22-24, and 26 as unpatentable under U.S.C. 103(a) over Carcerano et al. in view of admitted prior art (AAPA).

In Section 15 of the Office Action claims 6, 8-11, 20, 22-24, and 26 have been rejected under 35 U.S.C. 103(a) as unpatentable with respect to Carcerano, in view AAPA. With respect to claims 9-10 and 23-24, the Office Action states that Carcerano fails to teach True/False answer, but that it would have been obvious to combine the True/False answers taught in the AAPA with Carcerano "to provide a method of querying devices for status information by labeling a device as unavailable if the device replies to a query and unavailable if the device fails to respond." With respect to claim 11, the Office Action states that Carcerano teaches spawning a thread to a network-connected device such as a printer, copier, scanner, or the like. With respect to claim 26, the Office Action states that Carcerano teaches a refresh command.

An invention is unpatentable if the differences between it and the prior art would have been obvious at the time of the invention. As stated in MPEP § 2143, there are three requirements to establish a *prima facie* case of obviousness.

> First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. *In re Vaeck* 947 F.2d 488, 20 USPQ2d, 1438 (Fed. Cir. 1991).

Beginning at page 1, ln. 25, the Applicant's specification states that conventional systems "build the GUI to validate device availability only *after* (emphasis added) it has received replies from all the components (network devices) whose existence the application wants to query." This conventional process is described in more detail in the explanation of Fig. 1, where it states that Step 12 sends queries to network-connected devices, and Step 16 waits for all the queries (threads) to return with an answer. Only after these 2 steps are taken, is the GUI built in Step 18 (page 2, ln. 21. through page 3, ln. 4). It takes as long as 30 seconds for a time-out to occur, if a device does not respond to a query. Due to the time-out problem, status updates can be delayed as long as 30 seconds. Unlike the AAPA, the claimed invention GUI is built *before* queries are sent out to the network-connected devices.

With respect to the *first prima* facie requirement needed to support a case of obviousness, there must be some suggestion to combine the prior art references in a manner that makes the claimed invention obvious. If there is a motivation to combine the AAPA and Carcerano references based upon their common use of conventional device discovery processes, any modifications suggested by the combination would not make the limitations of claims 1 and 15 obvious. In fact, the combination of references can be said to point away from the claimed invention.

"(A)n applicant may rebut a prima facie case of obviousness by showing that the prior art teaches away from the claimed invention in any material respect." *In re Geisler*, 116 F.3d at 1469, 43 USPQ2d at 1365 (quoting *In re Malagari*, 499 F.2d at 1303, 182 USPQ at 553). Here, both the AAPA and Carcerano describe conventional discovery procedures that build a database or GUI only after attempting to query (discover)

connected devices. Therefore, the combination of references merely reinforces convention.

The second *prima facie* requirement addresses the same issue from another point of view. Even if an expert were given the two references are a starting point, there is no reasonable expectation that this expert would come up with the claimed invention. Carcerano does not address the network time-out discovery problem. The AAPA mentions the problem, but proposes no solution. Since neither of the references describes a solution to the time-out problem, it is difficult to image how the combination of references describes a solution.

With respect to the third requirement to support a *prima facie* case of obviousness, the combination of references does not teach all the limitations of claims 1 and 15. As noted above in response to the anticipation rejection, claims 1 and 15 recite building a GUI representation of network-connected devices, and only after building the GUI, sending queries to the devices to determine their status.
Both Carcerano and the AAPA only describe building a GUI after all the device query responses are received. Thus, the combination of the AAPA with Carcerano does not explicitly teach all the limitations of claims 1 and 15. Neither do the references suggest any modifications that make these claims obvious. Claims 6 and 8-11, dependent from claim 1, and claims 20, 22-24, and 26, dependent from claim 15, enjoy the same distinctions.

SUMMARY AND CONCLUSION

It is submitted that for the reasons pointed out above, the claims in the present application clearly and patentably distinguish over the cited references. Accordingly, the Examiner should be reversed and ordered to pass the case to issue.

Authorization is provide, in the amount of $500.00, to cover the fee for this Appeal Brief. Authorization is given to charge any deficit or credit any excess to Deposit Account No. 502,033.

Respectfully submitted,

Date: 6/28/2006

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CLAIMS APPENDIX

1. (Previously Presented) In a network of devices, a method for a querying device to determine the availability of network-connected devices, the method comprising:

at a querying device, building a graphical user interface (GUI) representation of network-connected devices, prior to sending a query to network-connected devices;

following the building of the GUI, sending a query from the querying device to the network-connected devices;

in response to the queries, updating the GUI representation of the network-connected devices.

2. (Previously Presented) The method of claim 1 further comprising:

at a querying device user interface, issuing a network discovery command; and

wherein building the GUI includes building the GUI in real-time, in response to querying device user interface network discovery command.

3. (Previously Presented) The method of claim 2 wherein building the GUI includes initially representing each of the network-connected devices as unavailable.

4. (Previously Presented) The method of claim 3 wherein sending the query to the network-connected devices includes

spawning a thread from the querying device to query each of the network-connected devices; and

the method further comprising:

receiving a query reply from a first network-connected device; and

wherein updating the GUI representation includes changing the GUI representation of the first network-connected device to available.

5. (Previously Presented) The method of claim 4 further comprising:

failing to receive a query reply from a second network-connected device; and

wherein updating the GUI representation includes maintaining the GUI representation of the second network-connected device as unavailable.

6. (Previously Presented) The method of claim 5 wherein failing to receive a query reply from the second network-connected device includes:

accepting a timeout period for the second network-connected device query; and

if the timeout period expires before a query reply is received, determining that the second network-connected device is unavailable.

7. Canceled

8. (Previously Presented) The method of claim 6 wherein spawning a thread from the querying device to the network-connected devices includes using a function selected from the group including a Sockets connect function, a ping function, and a NSLookup function.

9. (Previously Presented) The method of claim 6 wherein spawning a thread from the querying device to the network-connected devices includes requesting a True/False answer;

wherein receiving a query reply from the first network-connected device includes returning a True answer; and

wherein changing the GUI representation of the first network-connected device to available includes changing the GUI representation to available in response to a True answer.

10. (Previously Presented) The method of claim 9 further comprising:

returning a False answer if the timeout period expires before a query reply is received for the second network-connected device; and

wherein maintaining the GUI representation of the second network-connected device as unavailable includes maintaining the GUI representation as unavailable in response to the False answer.

11. (Previously Presented) The method of claim 10 wherein building the graphical user interface (GUI) representation of network-connected devices includes building a GUI on a computer with a graphical interface; and

wherein spawning a thread from the querying device to the network-connected devices includes requesting the availability of network-connected devices selected from the group including printers, copiers, scanners, faxes, automatic teller machines (ATMs), remote sensors, virtual private network (VPN) devices, satellite devices, and other computers.

12. (Previously Presented) The method of claim 1 further comprising:

accepting a periodic refresh command; and

wherein building the GUI representation of network-connected devices includes refreshing the GUI in response to a refresh command.

13. (Previously Presented) In a network of connected devices, a method of building a graphical user interface (GUI) representing the availability of the network-connected devices independent of system timeouts, the method comprising;

from a querying device, building a graphical user interface (GUI) representation of network-connected devices initially representing network-connected devices as unavailable;

sending a query to a network-connected device; and

modifying the GUI representation of the network-connected device in response to sending the query.

14. (Previously Presented) The method of claim 13 wherein building the GUI includes initially representing the network-connected device as unavailable;

the method further comprising:

receiving a query reply from the network-connected device; and,

wherein modifying the GUI representation includes representing the network-connected device as available in response to the query reply.

15. (Previously Presented) In a network of connected devices, a system for displaying network device availability, the system comprising:

a querying device having a graphical user interface (GUI) representing network-connected devices, the querying device having a network connection port;

at least one device having a network connection port for communications with the querying device; and

wherein the querying device sends a query to5 network-connected devices, after building the GUI, and updates the GUI representation of the network-connected devices in response to sending the queries.

16. (Previously Presented) The system of claim 15 wherein the querying device has a user interface to accept commands; and

wherein the querying device builds the GUI in real-time, in response to commands from the querying device user interface.

17. (Original) The system of claim 16 wherein the GUI initially represents each of the network-connected devices as unavailable.

18. (Previously Presented) The system of claim 17 wherein the querying device spawns a thread to query each of the network-connected devices, and in response to receiving a query reply from a first network-connected device, changes the GUI representation of the first network-connected device to available.

19. (Previously Presented) The system of claim 18 wherein the querying device maintains the GUI representation of a second network-connected device as unavailable, in response to not receiving a query reply from the second network-connected device.

20. (Previously Presented) The system of claim 19 wherein the querying device further includes an operating system and a timer configured with a default timeout value;

wherein the querying device maintains the GUI representation of the second network-connected device as unavailable, in response to not receiving a query reply, as follows:

starting the timer at the beginning of each network-connected device query; and

if the timeout period expires before a query reply is received from the second network-connected device, determining that the second network-connected device is unavailable.

21. Canceled

22. (Original) The system of claim 20 wherein the querying device spawns a thread to query each of the network-connected devices by using function selected from the group including a Sockets connect function, a ping function, and a NSLookup function.

23. (Previously Presented) The system of claim 22 wherein the querying device GUI requests a True/False answer in response to each network-connected device query;

wherein the querying device GUI receives a True answer from the first network-connected device; and

wherein the querying device GUI changes the representation of the first network-connected device to available in response to a True answer.

24. (Previously Presented) The system of claim 23 wherein the querying device generates a False answer in response to a the timeout period expiring before a query reply is received for the second network-connected device; and

wherein the querying device GUI maintains the representation of the second network-connected device as unavailable in response to the False answer.

25. (Original) The system of claim 15 wherein the querying device is a computer and the GUI is represented on a visual display attached to the computer; and

wherein the network-connected devices are selected from the group including printers, copiers, scanners, faxes, automatic teller machines (ATMs), remote sensors, virtual private networks (VPNs), satellite devices, and computers.

26. (Previously Presented) The system of 20 wherein the timer is configured with a refresh rate value; and

wherein the querying device accepts commands for spawning threads to network-connected devices at the refresh rate value; and

wherein the querying device refreshes the GUI, in real-time, in response to the refresh rate value.

EVIDENCE APPENDIX

ATTACHMENT A

SYSTEM AND METHOD FOR DISCOVERING AVAILABLE NETWORK COMPONENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention generally relates to computer software and, more particularly, to a system and method of building a graphical user interface (GUI), in real-time, to discover connected network devices.

2. Description of the Related Art

It is conventional for a computer, or a plurality of computers to be networked together for the purposes of cooperation and function sharing. Alternately, a computer or plurality of computers can be linked to devices or elements having specialized functions, such as a printer. The specialized function device can be sometimes be a specialized function computer. It is also conventional that once a network is configured, with links, addresses, and communications established between the network devices, that it remains configured, even when devices are shut down, restarted, or the power recycled. Once a list of components or network devices exists, there is a need to validate each component's existence every time the program is executed. For example, a personal computer (PC) connected to a network of printers will validate communications to each of the network printers when the PC is booted up.

Conventional systems build the GUI to validate device availability only after it has received replies from all the components (network devices) whose existence the application wants to query.

This solution is not a real-time operation, as it is characterized by a response time that is relatively slow, often several seconds. This is time that the system user feels is wasted, as the user is often staring at a display waiting for the GUI to appear. The wait time further depends on the accessibility of the queried devices. If a device is not accessible to the network, it being turned off, broken, or disconnected from the network, the prior art system waits for the expiration of a timeout period, begun at the time the query was initiated. When a device is accessible, the response to the query arrives within approximately 200 milliseconds. When the device is not accessible, the response to the query arrives after the timeout period has expired. The timeout period is not necessarily configurable (i.e., WinSock API). The network operating system may determine the timeout periods. As a result, if only one of the queried network elements is not accessible, the response time is multiplied by a factor of approximately 150, when compared to the case when all the network elements are accessible. This analysis is based on the assumption that a timeout is typically configured to be around 30 seconds, and a query for a network element or online component takes 200 milliseconds. Note, the timeout periods will vary between different operating systems.

Fig. 1 is a flowchart illustrating steps in the method of building a GUI of accessible network devices (prior art). The method starts at Step 10. In Step 12 N threads are spawned from a querying device to each of the N network device. The process must wait for termination of all these threads. In Step 14 all the N spawning threads execute in parallel. In Step 16 the process waits for all the

spawned threads to finish and to return their answer. In Step 18, after all the queries are answered, the GUI is built. This is the first time at which the user can see and interact with the GUI. The GUI gets built according to information (accessible or not accessible) that the N threads have returned.

Fig. 2 is a flowchart illustrating Steps 14 and 16 of Fig. 1 in greater detail (prior art). In Step 14a each thread, here represented by thread 1, performs a query. If the corresponding component is present, the reply to the query will be swift, and the thread will immediately return a positive (True) value, Step 16a. If the corresponding network element is offline, a timeout period will expire (Step 16b), and the query will return a False value (Step 16c).

It would be advantageous if a method existed to more immediately supply a computer user with the results of networked devices accessibility query.

It would be advantageous if a GUI could be built to immediately provide a computer system user of the status of network device accessibility queries.

SUMMARY OF THE INVENTION

The present invention provides an instantaneous real-time indication of all available devices. Given a querying device and a list of devices to which it is connected, a determination is made as to which devices are accessible or available to the querying device through a network. The querying device and the list of devices may or may not be connected to the network. It is assumed that the query is

presented to the user through a GUI and that the user is issuing a query command through a keystroke (e.g., enter key) or a mouse click. The solution gives the user a good experience by delivering the response in real-time, e.g., within less than *0.5* seconds.

Accordingly, a method has been provided for a querying device to determine the availability of known network-connected devices. The method comprises: from a querying device user interface, issuing a command requesting that the availability of the network-connected devices be determined; building a graphical user interface (GUI) in real-time representing the availability of network-connected devices; representing each of the network-connected devices in the GUI as unavailable; and, querying the network-connected devices to determine their availability.

More specifically, the method comprises: spawning a thread from the querying device to query each of the network-connected devices; in response to receiving a query reply from a network connected device, changing the GUI representation of that particular network device to available; or, in response to not receiving a query reply from a network connected device, maintaining the GUI representation of the particular network device as unavailable.

Typically, building a GUI representing the availability of network at a querying device includes building a GUI on a computer with a graphical interface; and, issuing commands requesting the availability of the network-connected devices includes requesting the availability of network-connected devices selected from the group

including printers, copiers, scanners, faxes, computers, and equivalent devices.

Additional details of the above-mentioned method, and a system for querying the availability of network of connected devices are provided below.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a flowchart illustrating steps in the method of building a GUI of accessible network devices (prior art).

Fig. 2 is a flowchart illustrating Steps 14 and 16 of Fig. 1 in greater detail (prior art).

Fig. 3 is a schematic block diagram illustrating the present invention system for displaying network device availability, in a network of connected devices.

Fig. 4 is a sample illustration of the GUI from Fig. 3.

Fig. 5 is another sample illustration of the GUI from Fig. 3, following the return of the availability queries.

Fig. 6 is a flowchart illustrating steps in the present invention method of building a GUI in real-time.

Fig. 7 is a detailed illustration of Steps 608 and 610 of Fig. 6.

Fig. 8 is a timing diagram illustrating the above-described present invention method.

Fig. 9 depicts sample code that represents the known network-connected devices as unavailable when the GUI is initialized.

Fig. 10 is sample code depicting the thread spawning function.

Fig. 11 is sample code depicting the attempt to establish a socket connection.

Fig. 12 illustrates the operation of the connect() function.

Fig. 13 is a flowchart illustrating a method for a querying device to determine the availability of network devices in a network of connected devices.

Fig. 14 is an alternate representation of the method of building a graphical user interface (GUI) representing the availability of network-connected devices independent of system timeouts.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 3 is a schematic block diagram illustrating the present invention system for displaying network device availability, in a network of connected devices 100. A querying device 102 has a graphical user interface (GUI) 104 representing the availability of known network-connected devices. The known network-connected devices shown are: device 1 (106), device 2 (108), device 3 (110), device 4 (112), device 5 (114), and device 6 (116). Although six network-connected devices are shown it should be understood that the invention is not limited to any particular number of network-connected devices. It should also be understood that although only a single querying device is shown, the invention is not necessarily so limited. In some aspects of the invention, the querying device 102 is a computer and the GUI 104 is represented on a visual display attached

to the computer 102. The network-connected devices 106-116 are selected from the group including printers, copiers, scanners, faxes, automatic teller machines (ATMs), remote sensors, virtual private network (VPN) elements, satellite elements, computers, and equivalent devices. There are devices with many other functions that could also be mentioned as being connected to a network.

The querying device 102 has a network connection port connected to line or network connection 118. At least one device (six are shown) has a network connection port for communications with the querying device 102 on line 118. The querying device 102 has, or is connected to a user interface, such as a mouse or keyboard to accept commands requesting the availability of the network-connected devices 106-116. In some aspects of the invention the request is embedded in software and automatically enabled in response to an event such as powering up the querying device 102. The querying device 102 builds the GUI 104, in real-time, representing the availability of network devices 106-116, in response to commands from the querying device user interface 118.

In some aspects of the invention, the real-time building of the GUI 104 occurs within approximately 0.5 seconds of the command from the user interface 118, or in response to a refresh command. The exact time may vary in response to devices, operating systems, and network connections. The term real-time is intended to refer to a very brief period of time that the querying device user perceives to be for instantaneous or almost instantaneous. Following the building of the GUI 104, the querying device 102 queries the

known network-connected devices 106-116 to determine their availability.

Fig. 4 is a sample illustration of the GUI 104 from Fig. 3. In this example, device 1 (106) is Cougar01, device 2 (108) is Cougar02, device 3 (110) is Leopard01, device 4 (112) is Leopard02, device 5 (114) is Leopard03, and device 6 (116) is Leopard04. The querying device GUI 104 initially represents each of the known network-connected devices 106-116 in the GUI as unavailable. Each of the network-connected devices 106-116 is represented by an icon when available. If the devices are copiers, the icons can be made to resemble a copier. If the devices are not available, the unavailable state can be represented as a "crossed-out" icon, or an "X" superimposed over the icon. There are a number of different ways in which available and unavailable devices can be represented and the invention is not limited to the representations of the example in Fig. 4.

Returning to Fig. 3, the querying device 102 spawns a thread to query each of the network-connected devices 106-116, and in response to receiving a query reply from a network connected device, changes the GUI 104 representation of that particular network connected device to available. The querying device 102 maintains the GUI representation of the particular network device as unavailable, in response to not receiving a query reply from that particular network connected device. More particularly, the querying device 102 further includes an operating system (not shown) and a timer 120 configured with a default timeout value. In some aspects of the invention the operating system provides the default timeout value. In other aspects,

the user is able to configure the timeout value for the present invention availability GUI. In either case, or regardless of the default timeout value, the GUI 104 is built instantaneously and the available devices are updated in real-time.

The querying device 102 maintains the GUI representation of the particular network device as unavailable, in response to not receiving a query reply, as follows. The timer 120 is started at the beginning of each network connected device query. If the timeout period expires before a query reply is received from a network-connected device, that the particular network connected device is determined to be unavailable.

In some aspects of the invention the timer 120 is configured with a refresh rate value. Then, the querying device 102 accepts commands requesting the availability of the network-connected devices at the refresh rate value. The GUI 104 is refreshed, in real-time, in response to the refresh rate value. That is, queries are made again, and the GUI changes in response to the queries as described above. In some aspects the refreshing GUI again assumes that all devices are initially unavailable, and the GUI changes state to represent communicating devices as available in real-time. Alternately, the GUI is initiated using the GUI status from the previous refresh cycle. For example, the GUI may be refreshed every 60 seconds. Frequent refresh rates are not a penalty, since the GUI refresh process does not hang the system up in waiting for unavailable network-connected device timeouts.

The querying device GUI 104 requests a True/False answer in response to each network connected device query. The querying device GUI 104 receives a True answer from available network-connected devices, and changes the representation of that particular network device to available in response to a True answer. Likewise, the querying device 102 generates a False answer in response to a the timeout period expiring before a query reply is received for a network connected device, and the querying device GUI 104 maintains the representation of the particular network device as unavailable in response to the False answer.

Fig. 5 is another sample illustration of the GUI 104 from Fig. 3, following the return of the availability queries. Out of a total of six copiers, four are active. The GUI changes the icon for each of these available copiers, from unavailable (initial state) to available, relatively quickly. The two copiers that are unavailable maintain the unavailable icon that was initially set up when the GUI was first built.

Returning to Fig. 3, in some aspects of the invention the querying device 102 spawns a thread to query each of the network-connected devices 106-116 by using a Sockets connect function to attempt a socket connection to each of the network-connected devices.

The present invention improves upon prior art solutions in two aspects:

1. When N devices are queried in the present invention, the average, minimum and maximum response time, from query initiation to GUI presentation is immediate, or o(1), while the

prior art response time is o(<timeout-period>), or dependent upon externally controlled factors that make the response time lengthy;

2. When k devices are not accessible, the present invention response time is again immediate, or o(1), while the prior art response time is again lengthy, or o(<timeout-period>).

The benefit of the invention results from the real-time GUI response. There is a list of components (devices) in the network whose existence needs to be validated. The algorithm attempts to open a socket connection in order to verify whether or not the remote component is alive, using the Sockets connect function for example. While prior art methods also use socket connections to discover network-connected devices, the present invention utilizes socket connections in a new combination, executed in parallel with a GUI context.

The invention builds a GUI depicting all the components as disabled. Subsequently, it spawns N threads, one per each component in the querying device's list. Every thread queries the corresponding device and returns a True/False answer. If the device is alive, the query returns immediately with a True answer and enables the corresponding GUI element in the querying device, by showing the device as being available. If the queried device is offline, the query returns False, but only after a timeout period. A False reply indicates that the device is offline and instructs the querying thread not to change the state of the GUI, leaving the icon disabled (shown as unavailable).

Fig. 6 is a flowchart illustrating steps in the present

invention method of building a GUI in real-time. The method begins at Step 600. At Step 602 the GUI is built. The application constructs its GUI representing every known network component (device) with a corresponding GUI icon or representation. In Step 604 the GUI represents every GUI device with its 'disabled' or unavailable state. In Step 606 N threads are spawned. The process does not wait for termination of those threads. In Step 608 all the threads execute in parallel. In Fig. 610 the GUI is modified to depict available devices.

Fig. 7 is a detailed illustration of Steps 608 and 610 of Fig. 6. In Step 608a each thread, here represented by thread 1, performs a query. If the corresponding component (device) is present, the reply to the query will be swift, and the thread will immediately return a positive (True) value, Step 608b. The thread will immediately replace the unavailable icon with an available icon, and the thread will terminate. That is, the GUI is modified in response to the True answer (Step 610). If the corresponding network element is offline, a timeout period will expire (Step 608c), and the query will return a False value (Step 608d). In response to a False answer the GUI device status is maintained as unavailable.

Fig. 8 is a timing diagram illustrating the above-described present invention method. In this figure, threads 2, i, and N-1 timeout. The remaining threads return a True response, and the GUI changes to show these threads (network-connected devices) as available.

Some functions, such as connect(), will timeout automatically. The timeout for connect() affects non-blocking as well

as blocking operations. The GUI application does not have any control over the timeout period for these functions, however, the network system alone determines when their timeout occurs. These network-system timeouts are related to the timeouts implemented for the protocols in use (e.g., ARP timeout, TCP SYN, ACK timeouts, or DNS query timeouts). The WinSock API does not provide a way to detect or change these network-system timeout values.

Fig. 9 depicts sample code that represents the known network-connected devices as unavailable when the GUI is initialized. This function gathers an array of known GUI components (devices). The function first disables all the GUI components, to let them appear offline (See Fig. 4), and then starts a thread per component that will validate the component's existence, and enable the components that are online.

Fig. 10 is sample code depicting the thread spawning function. Thread is spawned, one per network component (device). The thread queries to determine if the component is alive. If it's alive, the QueryRemoteHost() function will return immediately and the thread will enable (show as available) the GUI icon or representation corresponding to the network device. If, however, the network device is offline and does not respond to the socket connection, the function call OueryRemoteHost() returns after a timeout period, and the thread terminates, not changing the GUI.

Fig. 11 is sample code depicting the attempt to establish a socket connection. This function gets an IP address as input and attempts to establish a socket connection with the remote host. If the

component is alive, the function will return immediately with a positive return value (True), but if the network component is not alive, then the function is time extensive and will return only upon timeout.

Since a stream (TCP) client is connection-oriented, it must initiate a connection to create an association. This is done by calling the connect() function, which initiates the creation of a virtual circuit on a TCP socket, or sets a default socket name for a UDP socket. For example:

```
int PASCAL FAR connect (SOCKET s,          / * an.
unconnected socket */
struct sockaddr FAR addr,      /*  remote port and I P addr */
int namelen) ;                 /* addr structure length */
```

S socket handle

addr: pointer to a socket address structure (always a sockaddr_in structure for TCP/IP)

l2amelefl: length of structure pointed to by *addr*

The connect() function returns zero on success or SOCKET_ERROR on failure. For a TCP socket, the most common error is usually WSAECONNREFUSED (10061). There are only a few cases that cause this error: The server is not running, the *sin port* is incorrectly initialized on the client (or server), or the wrong IP address is selected.

Fig. 12 illustrates the operation of the connect() function. The connect() function assigns the remote IP address, port

Number, and implicitly names the local socket, if not yet explicitly named. It also initiates communication to the server socket over the network.

The invention could be implemented in any given programming language, such as Java, Basic, etc. The invention can use any protocol to discover a network component, such as ping, NSLookup, etc. If needed, the invention can be called within a timer procedure. In that case, the GUI is updated periodically.

Fig. 13 is a flowchart illustrating a method for a querying device to determine the availability of network devices in a network of connected devices. Although the method is depicted as a sequence of numbered steps for clarity, no order should be inferred from the numbering unless explicitly stated. The method begins at Step 1300. Step 1302, at a querying device user interface, issues a command requesting the availability of devices known to be connected to the network. Step 1304 builds a GUI representing the availability of known network-connected devices. Step 1306, following the building of the GUI, queries the network-connected devices to determine their availability to the querying device. Building a GUI representing the availability of known network devices in Step 1304 includes building the GUI in real-time, in response to querying device user interface command. Building the GUI in real-time includes building the GUI within 0.5 approximately seconds of the query device user interface command. Alternately, the real-time response can be considered as one that appears instantaneous, or almost instantaneous to the user.

Step 1305, following the building of the GUI, represents each of the known network-connected devices in the GUI as unavailable. Querying the known network-connected devices in Step 1306 includes spawning a thread from the querying device to query each of the network-connected devices. Then, Step 1308 receives a query reply from a network connected device. Step 1310, in response to receiving a query reply from a network connected device, changes the GUI representation of that particular network device to available. Likewise, Step 1312, fails to receive a query reply from a network connected device. Step 1314, in response to failing to receive a query reply from a network connected device, maintains the GUI representation of the particular network device as unavailable.

In some aspects of the invention, failing to receive a query reply (Step 1312) includes substeps. Step 1312a accepts a timeout period for each network connected device query. Step 1312b, if the timeout period expires before a query reply is received, determines that the particular network connected device is unavailable.

In some aspects of the invention, spawning a thread from the querying device to query each of the known network-connected devices in Step 1306 includes using a function selected from the group including a Sockets connect function, a ping function, and a NSLookup function.

In some aspects of the invention, spawning a thread from the querying device to query each of the known network-connected devices in Step 1306 includes requesting a True/False answer. Then, receiving a query reply from a network connected device in Step 1308

includes returning a True answer. Changing the GUI representation of that particular network device to available in Step 1310 includes changing the GUI representation to available in response to a True answer.

Step 1312c returns a False answer if the time-out period expires before a query reply is received for a network connected device. Then, maintaining the GUI representation of the particular network device as unavailable in Step 1314 includes maintaining the GUI as unavailable in response to the False answer.

In some aspects of the invention, building a graphical user interface (GUI) representing the availability of network in Step 1304 includes building a GUI on a computer with a graphical interface. Issuing commands requesting the availability of the network-connected devices in Step 1302 includes requesting the availability of network-connected devices selected from the group including printers, copiers, scanners, faxes, automatic teller machines (ATMs), remote sensors, VPN devices, satellite devices, other computers, and equivalent devices.

In some aspects of the invention a further step, Step 1316 accepts a periodic refresh command. Then, the method returns to Step 1304 where the GUI representing the availability of known network-connected devices is rebuilt or refreshed in response to the refresh command of Step 1316.

Fig. 14 is an alternate representation of the method of building a graphical user interface (GUI) representing the availability of network-connected devices independent of system timeouts. The

method starts at Step 1400. Step 1402, from a querying device, builds a GUI representing the availability of known network-connected devices. Step 1404 initially represents the network-connected devices as unavailable. Step 1406 modifies the GUI to represent available network devices in response to communicating with those particular network-connected devices. Step 1408 maintains the GUI to represent unavailable network devices in response the not communicating with those particular network-connected devices.

Examples of a system and method of providing a real-time GUI to depict the availability of known network-connected devices have been described above. The examples were intended to be as independent of particular operating systems, protocols, and coding languages as possible. Embodiments of the invention in specific operating systems, protocols, and languages will occur to those skilled in the art.

WE CLAIM:

SYSTEM AND METHOD FOR DISCOVERING AVAILABLE NETWORK COMPONENTS

ABSTRACT OF THE INVENTION

A system and method are provided for building a graphical user interface (GUI), in real-time, to depict the availability of known network-connected devices. Upon startup, the GUI represents each network connected element as unavailable. Then, each network element is queried. As communications are established with each network device, the GUI is modified to show that particular device as available. Thus, the GUI quickly changes from the initial state, to one where available devices are depicted. If communications cannot be established with a network element, the GUI representation of the device as unavailable is maintained. Thus, the GUI is initialized and modified independent of any timeouts associated with a failed network device communication.

ATTACHMENT B

Fig. 1
(PRIOR ART)

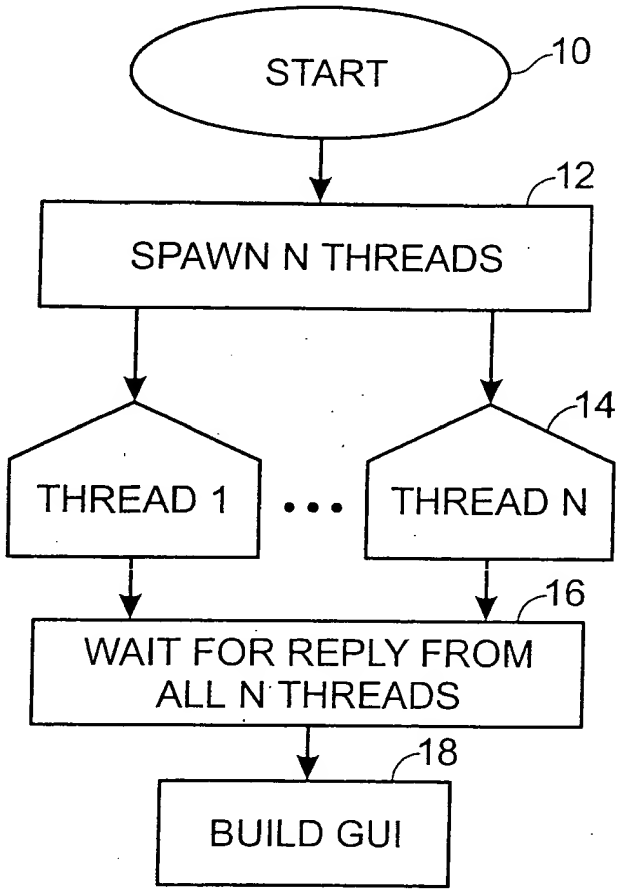


Fig. 2
(PRIOR ART)

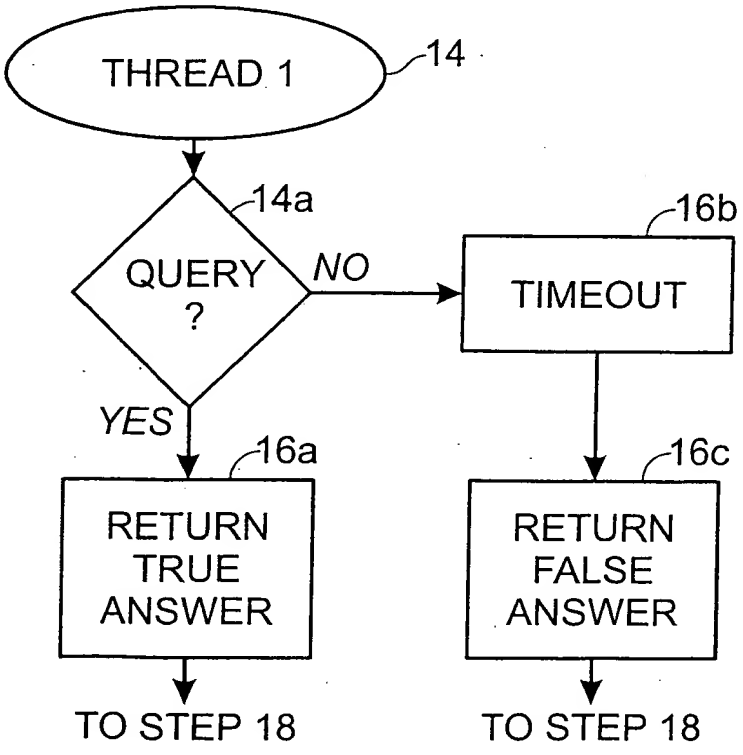


Fig. 3

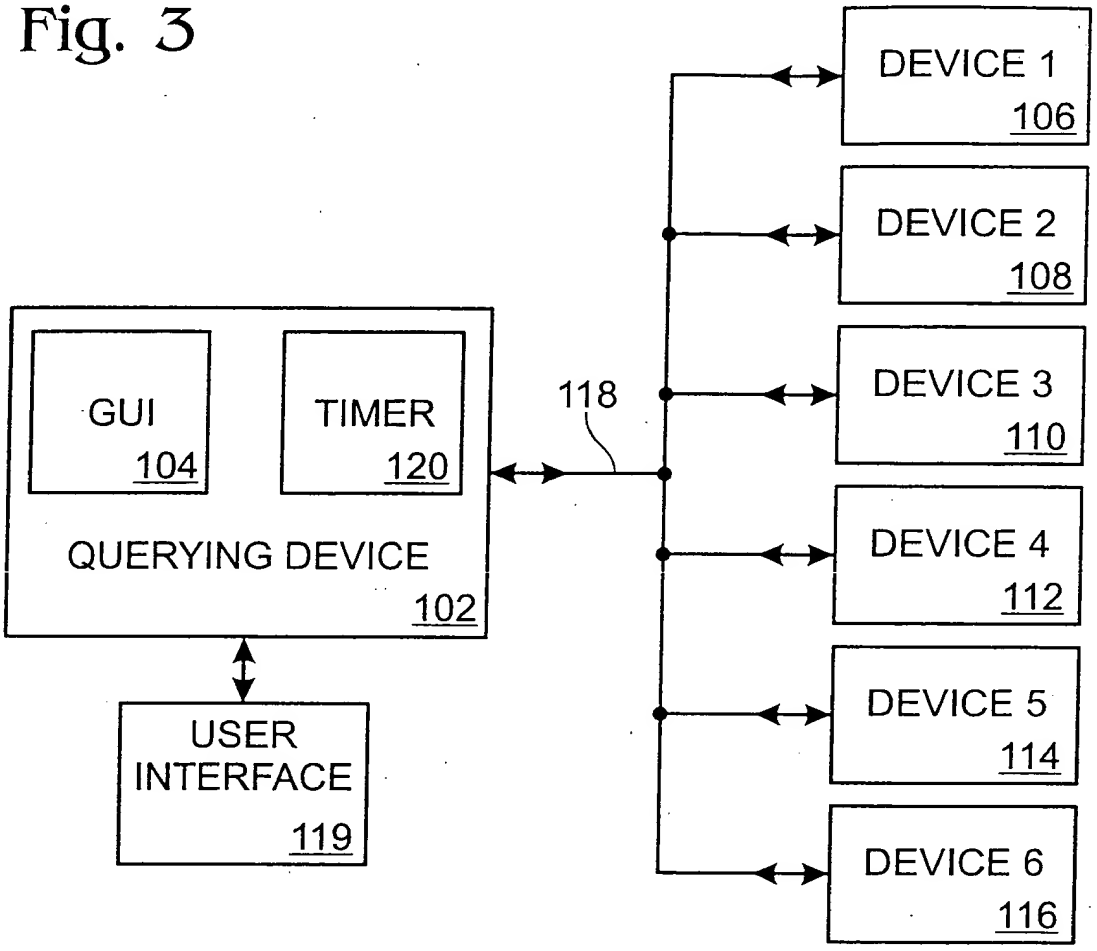

DEVICE 1
106
DEVICE 2
108
DEVICE 3
110
DEVICE 4
112
DEVICE 5
114
DEVICE 6
116
118
GUI
104
TIMER
120
QUERYING DEVICE
102
USER
INTERFACE
119

Fig. 4

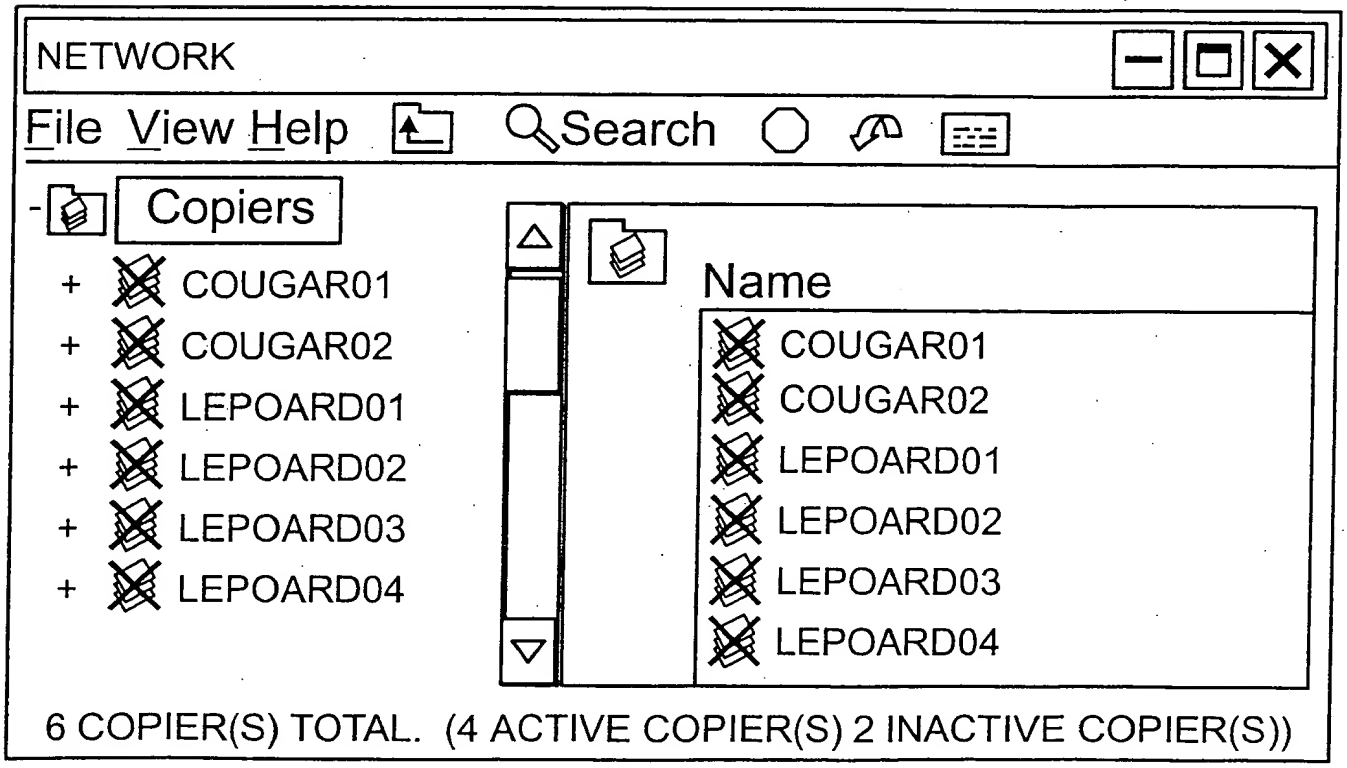

NETWORK
File View Help
Search
Copiers
+ COUGAR01
+ COUGAR02
+ LEPOARD01
+ LEPOARD02
+ LEPOARD03
+ LEPOARD04
Name
COUGAR01
COUGAR02
LEPOARD01
LEPOARD02
LEPOARD03
LEPOARD04
6 COPIER(S) TOTAL. (4 ACTIVE COPIER(S) 2 INACTIVE COPIER(S))

Fig. 5

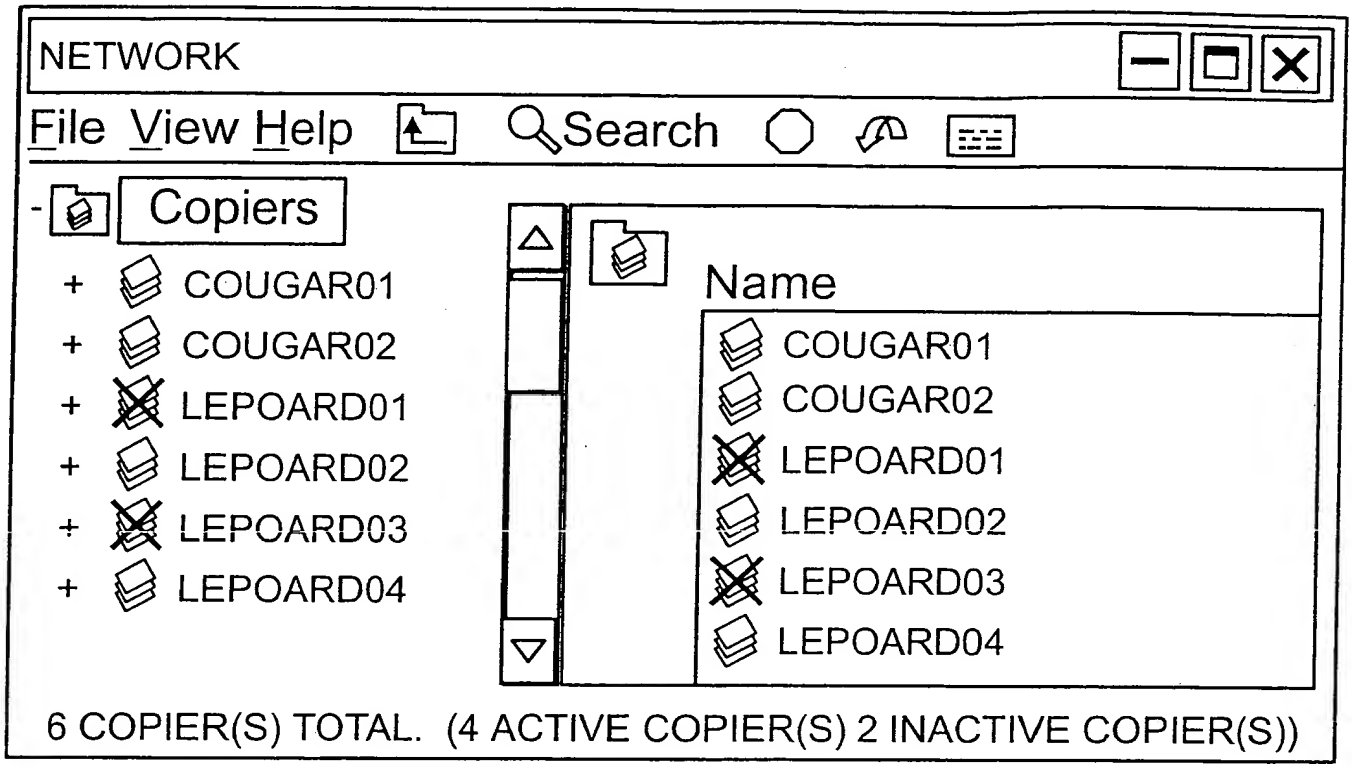

NETWORK
File View Help
Search
Copiers
COUGAR01
COUGAR02
LEPOARD01
LEPOARD02
LEPOARD03
LEPOARD04
Name
COUGAR01
COUGAR02
LEPOARD01
LEPOARD02
LEPOARD03
LEPOARD04
6 COPIER(S) TOTAL. (4 ACTIVE COPIER(S) 2 INACTIVE COPIER(S))

Fig. 6

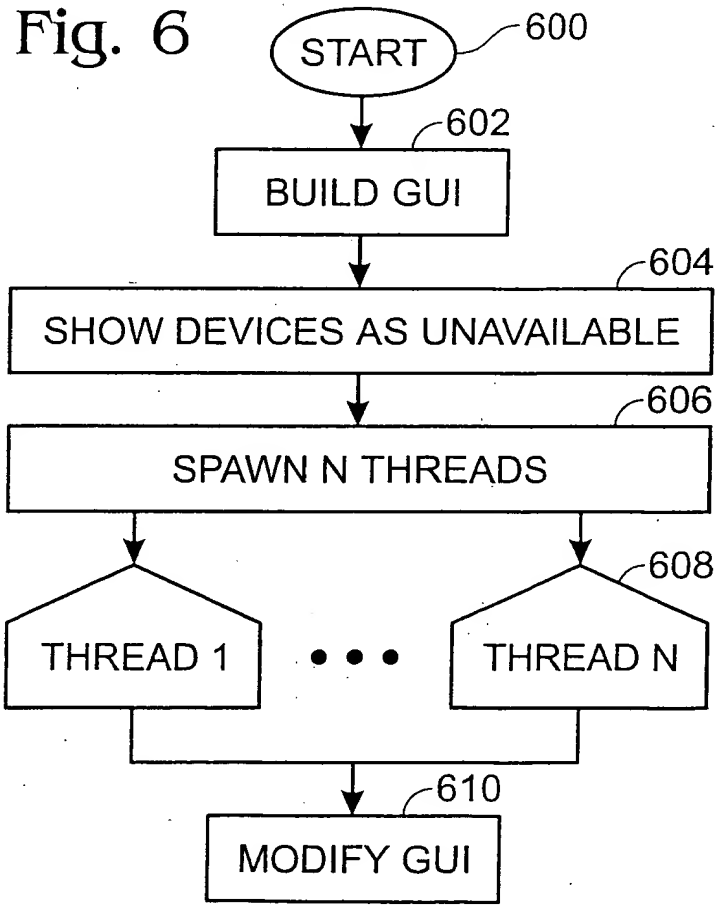

START
600
602
BUILD GUI
604
SHOW DEVICES AS UNAVAILABLE
606
SPAWN N THREADS
608
THREAD 1
THREAD N
610
MODIFY GUI

Fig. 7

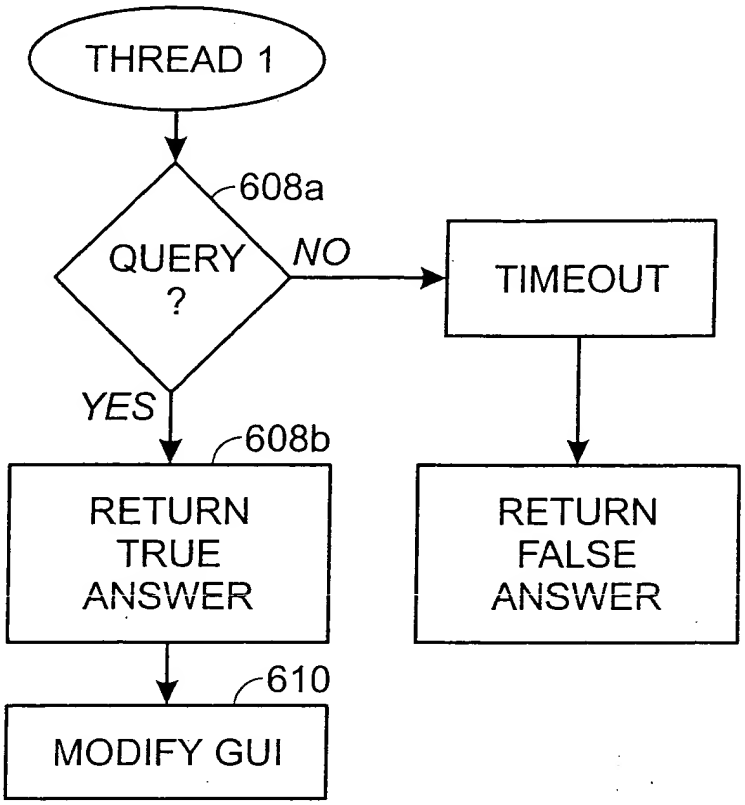

THREAD 1
608a
QUERY ?
NO
TIMEOUT
YES
608b
RETURN TRUE ANSWER
RETURN FALSE ANSWER
610
MODIFY GUI

Fig. 12

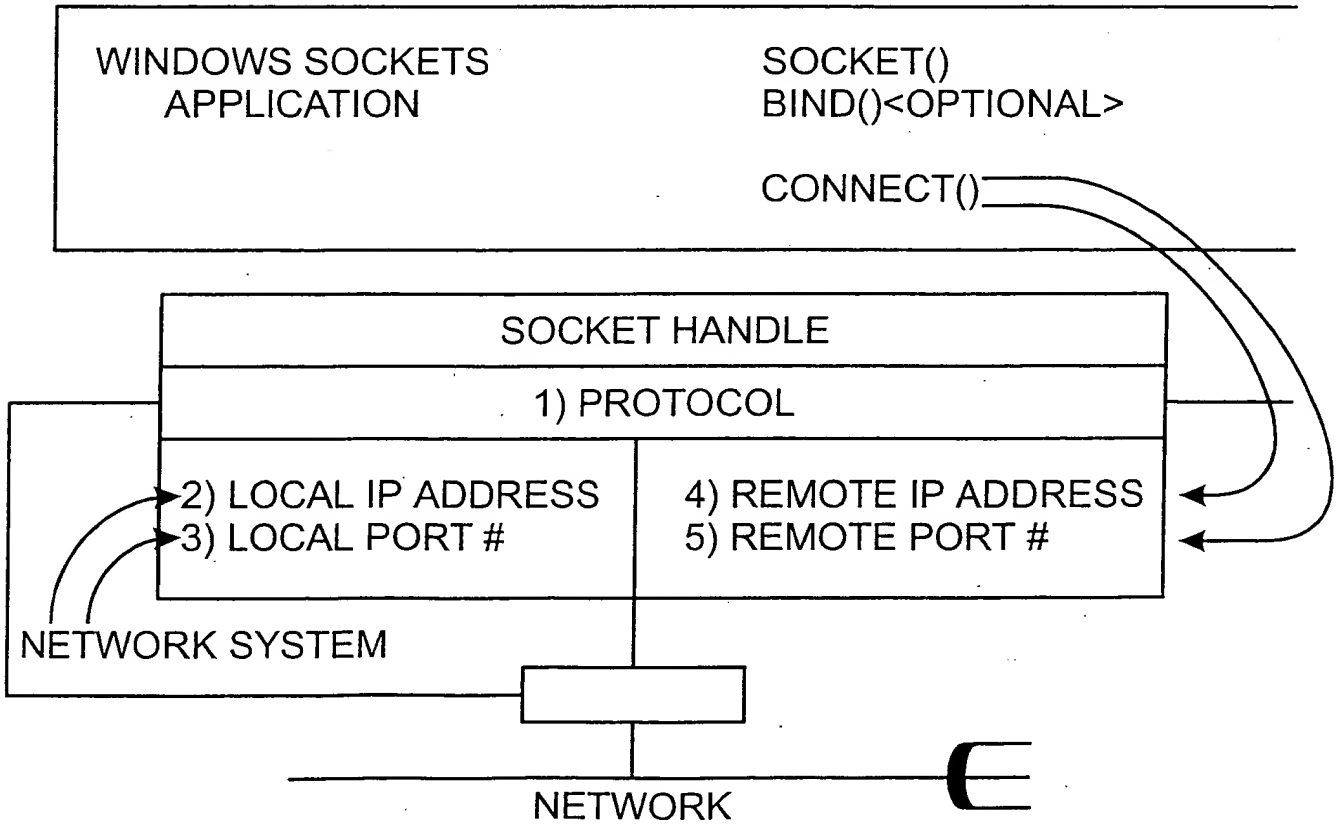

WINDOWS SOCKETS APPLICATION
SOCKET()
BIND()<OPTIONAL>
CONNECT()
SOCKET HANDLE
1) PROTOCOL
2) LOCAL IP ADDRESS
3) LOCAL PORT #
4) REMOTE IP ADDRESS
5) REMOTE PORT #
NETWORK SYSTEM
NETWORK

Fig. 8

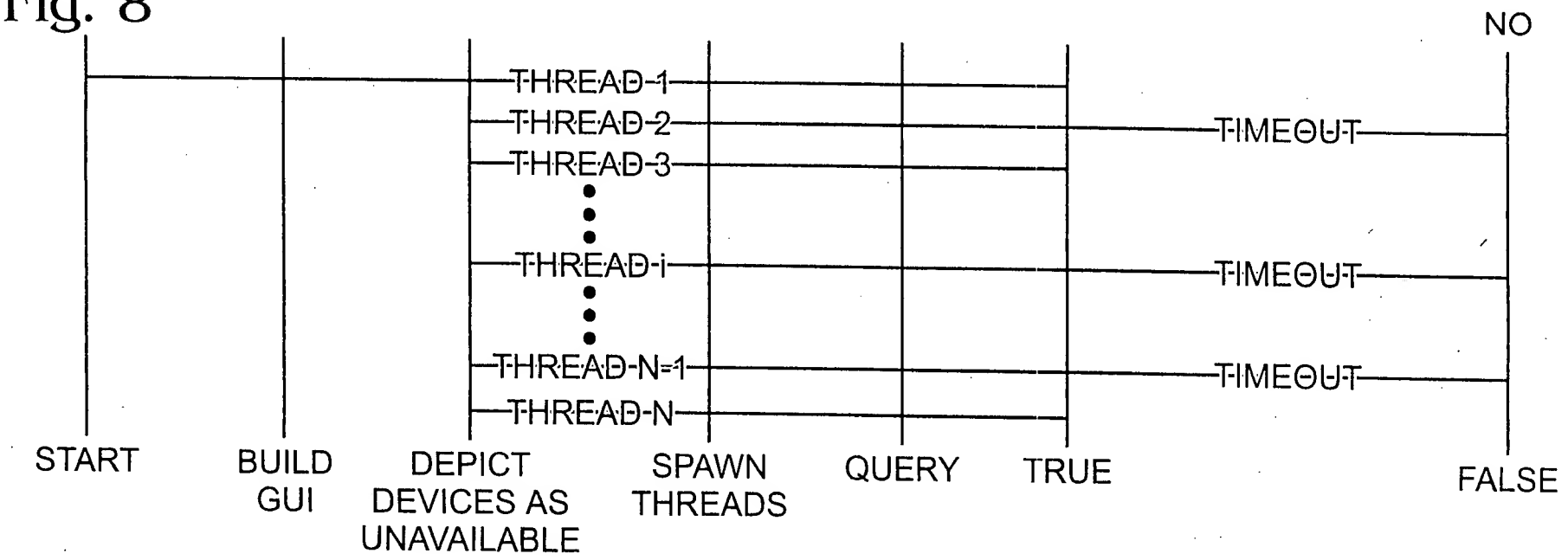


Fig. 9

```
// DoEnable() gets an array of GUI components, and will enable/disable the components based on their availability in the network.
Void DoEnable(GUIComponent arGUI[ ], unsigned short sz)
{
        // Disable entire GUI
        for (unsigned short I=0;I<sz;I++)
                arGUI[I].DisableComponent ();

        for (I=0;I<sz;I++)
        {
                AfixBeginThread(ValidateRemoteHost, (LPVOID) &arGUI[I]);
        }
}
```

```
Struct GUIComponent
{
        // will return IP address associated with the network component that the current GUI element represents.
        unsigned long GetIPAddress ();
        void EnableComponent(); // display component as active
        void DisableComponent(); // display component as inactive
};

// worker thread which will attempt a socket connection with remote host.
UINT ValidateRemoteHost( LPVOID pParam )
{
        GUIComponent * pGUIComponent =( GUIComponent *)pParam;

        if (QueryRemoteHost(pGUIComponent->GetIPAddress()) )
                pGUIComponent->EnableComponent();
        return 0;
}
```

Fig. 10

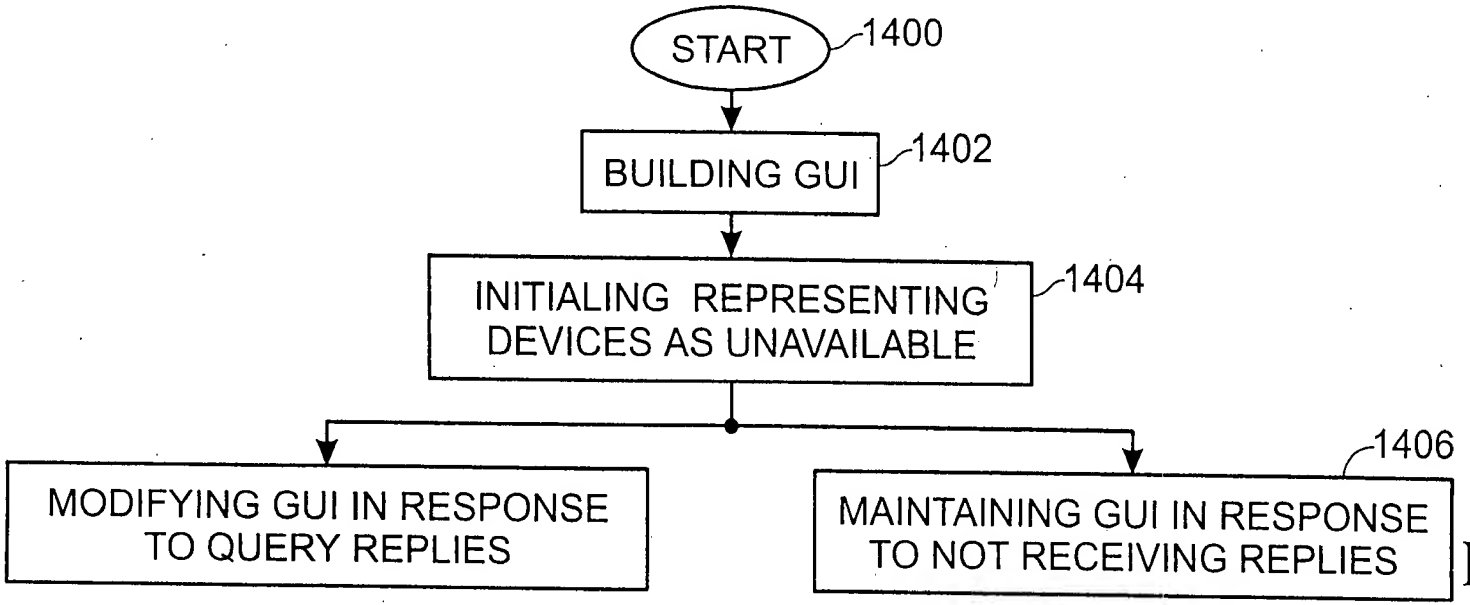


Fig. 14

Fig. 11

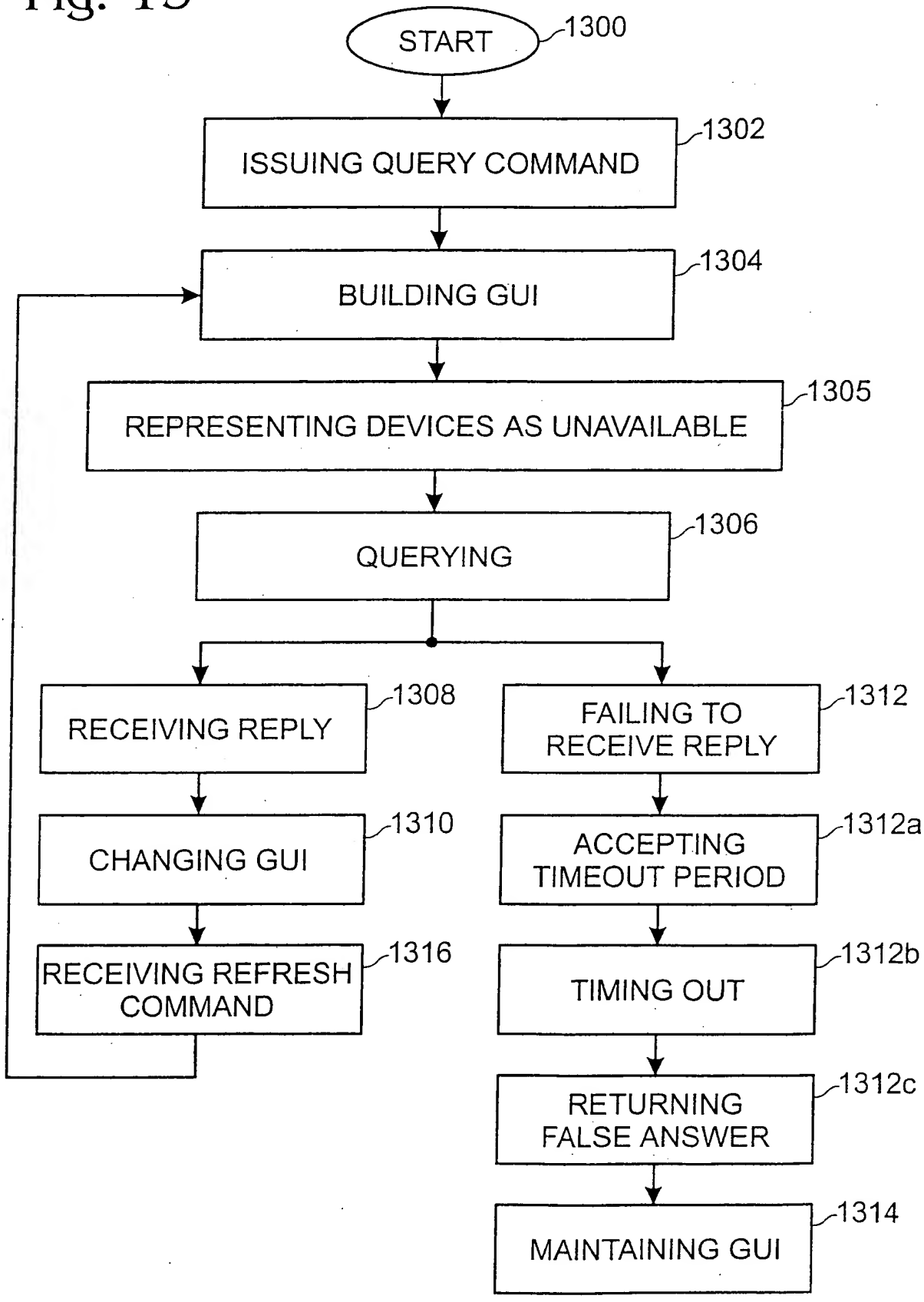
```
BOOL QueryRemoteHost(unsigned long lfpAdd)
{
        BOOL bRetVal=FALSE;
        // create new socket
        if ( INVALID_SOCKET==S)
                return FALSE;

        SOCKADDR_IN dest_sin;
        ZeroMemory(&dest_sin, sizeof(STOCKADDR_IN));
        dest_sin.sin_family == AF_INET;
        dest_sin.sin_port = htons(21);
        dest_sin.sin_addr.S_unS_addr = llpAdd;

        if (SOCKET_ERROR == connect(S,(PSOCKADDR)&dest_sin, sizeof( dest_sin)))
                bRetVal = FALSE;
        else
                bRetVal = TRUE;

        closesocket(S);
        return bRetVal;
}
```

Fig. 13


START
1300
ISSUING QUERY COMMAND
1302
BUILDING GUI
1304
REPRESENTING DEVICES AS UNAVAILABLE
1305
QUERYING
1306
RECEIVING REPLY
1308
CHANGING GUI
1310
RECEIVING REFRESH COMMAND
1316
FAILING TO RECEIVE REPLY
1312
ACCEPTING TIMEOUT PERIOD
1312a
TIMING OUT
1312b
RETURNING FALSE ANSWER
1312c
MAINTAINING GUI
1314

between the specimen melting point (M.P.) and the melting point (M.P.Q.) of a specimen after subsequent rapid liquid nitrogen quenching of an encapsulated [differential scanning calorimeter] sample from the melt." Id. at col. 5, ll. 2-6. The written description recites one example of how to measure the MPE, including a sample size, the rate of temperature increase for performing the test, and the equipment to be used:

[33] Melting points (M.P.) were determined with a Perkin-Elmer Differential Scanning Calorimeter (DSC) from the maxima of the endotherm resulting from scanning a 2 mg sample at 20ø C. per minute. . . . M.P. is taken to be the temperature of the highest temperature peak of the DSC trace.

[34] Id. at col. 4, l. 64-col. 5, l. 2. Notably, the written description does not disclose any method that must be used to prepare the PET yarn specimen for thermal analysis in the DSC.

[35] The sample PET yarn specimen can be produced in a number of different ways. Three sample preparation methods were published in the art as of the earliest priority date of the '976 patent. Those methods include: (1) the "coil method;" (2) the "cut method;" and (3) the "restrained method." See generally M. Jaffe, Fibers, in 7 Thermal Characterization of Polymeric Materials 709-92 (Edith A. Turi ed., 1981). A fourth method of sample preparation, the "ball method," was known to those of skill in the art at the time of the invention, but was not published. The only written description of the ball method in the record is a confidential Honeywell document.

[36] As each name suggests, the four sample preparation methods refer to the manner in which the yarn is gathered for testing. An operator measuring the MPE using the "coil method" grasps a yarn sample using a pair of tweezers and coils the yarn around the tips of the tweezers. The tweezers are then withdrawn from the sample as the resulting coil is deposited in the DSC pan for testing. See Order No. 61: Initial Determination Granting in Part and Denying in Part Respondents' Motion for Summary Determination of Non-Infringement and Invalidity of U.S. Patent No. 5,630,976, slip op. at 42 (USITC Feb. 4, 2002) ("Initial Determination"). Using the "cut method," a yarn sample is cut into tiny snippets with a razor blade or scalpel and then placed into the DSC pan before placing a lid on the pan. Id. Under the "restrained method," the ends of a yarn specimen are physically restrained during the heating to keep the sample length constant. See Jaffe, supra, at 721-22. Finally, when using Honeywell's "ball method," the operator grasps a yarn sample of a specified size using a pair of tweezers in one hand. The operator then twists it between the fingers of the other hand to start rolling the sample into a ball. The sample is then released from the tweezers, rolled completely into a ball, weighed, and then placed into a sample pan for testing. Initial Determination, slip op. at 41-42.

[37] Depending upon which sample preparation is used, the calculated MPE for a given sample can vary greatly. Specifically, the administrative law judge found that "[t]he ball method is the only sample preparation technique that has been shown to result in MPEs for the accused PET yarn products that fall within the claimed ranges and levels." See id. at 5. Using the cut method, the MPEs of the accused product fall outside the claimed ranges and levels. Id. No one challenges those findings on appeal.

[38] II.

[39] On May 17, 2001, the Commission instituted a patent-based investigation concerning the importation and sale of PET yarn and PET yarn-containing products. In this proceeding, Honeywell complained that

Hyosung was importing PET yarn and PET yarn-containing products produced by a process that infringed claims 1-2, 4-5, 7-8, 10-11, and 13-17 of the '976 patent in violation of section 337 of the Tariff Act of 1930. After the complaint was referred to an administrative law judge for an evidentiary hearing, Hyosung, supported by the Commission investigative attorney, moved for summary determination of non-infringement and invalidity of the '976 patent. Honeywell and Hyosung disputed, among other things, whether construction of the claims required the use of a particular sample preparation method. Honeywell argued that the claims must be construed to require measurement of the MPE using the ball method and not using the cut method, coil method, or restraining method. Hyosung did not offer a competing construction other than to argue that the claims should not be construed to specifically require the ball method.

[40] On February 4, 2002, the presiding administrative law judge issued the Initial Determination, a portion of which granted Hyosung's motion for summary determination of no infringement, and a portion of which denied Hyosung's motion as to patent invalidity. With respect to the claim construction issue, the administrative law judge held that "the term `melting point elevation' in the asserted claims of the '976 patent should be construed . . . to permit the measurement of melting points by means of any sample preparation method known to persons of ordinary skill in the art as of the earliest priority filing date of the '976 patent, which would include the cut method used by Hyosung." Id. at 26-27. Despite that broad construction, the administrative law judge then found that Hyosung did not infringe the asserted claims. Id. at 42. Furthermore, the administrative law judge held that Hyosung failed to prove by clear and convincing evidence that the claims at issue were invalid under 35 U.S.C. § 112, ¶¶ 1 and 2, due to indefiniteness, lack of enablement, or failure to provide an adequate written description. Id. Subsequently, Honeywell sought review from the Commission of the claim construction and the determination of non-infringement. Likewise, Hyosung and the Commission investigative attorney appealed the portion of the determination denying summary determination of invalidity.

[41] On March 21, 2002, the Commission declined to review the administrative law judge's determination of non-infringement. As such, the administrative law judge's initial determination became the final determination of the Commission. See 19 C.F.R. § 210.42(h) (2001). However, the Commission accepted the appeal of the denial of summary determination of invalidity, limiting its inquiry solely to the issue of indefiniteness under 35 U.S.C. § 112, ¶ 2.

[42] On appeal, the Commission reversed the administrative law judge's determination that Hyosung failed to prove by clear and convincing evidence that the claims were indefinite. Commission Opinion, slip. op. at 19. The Commission reasoned that "the published art of thermal analysis recognizes that the manner in which a PET yarn sample is prepared for testing affects the value of the melting point measurement obtained, and demonstrates that the practice in the art is to state which method of sample preparation is used." Id. at 16. Because the '976 patent's written description failed to disclose any particular method for PET yarn sample preparation, the Commission found "that the claims in issue are not `as precise as the subject matter permits,' particularly in view of the published literature in the field at the time of the filing of the '976 patent." Id. Thus, the Commission found those terms ambiguous and held that the claims were indefinite under 35 U.S.C. § 112, ¶ 2.

[43] In these consolidated appeals, Honeywell challenges the finding of non-infringement, arguing that the final determination rests upon a faulty claim construction. Honeywell also appeals the determination that the '976 patent is invalid. Hyosung filed a brief as intervenors. This court has jurisdiction pursuant to 28 U.S.C. § 1295(a)(6).

[44] DISCUSSION

[45] A. Standard of Review

[46] In appeals from the Commission under 28 U.S.C. § 1295(a)(6), the issue before this court is whether the Commission erred when determining whether a violation of section 337 of the Tariff Act of 1930 occurred. See 19 U.S.C. § 1337 (2000). We review the Commission's factual findings in accordance with the Administrative Procedure Act. See Id. § 1337(c). Such findings will be sustained unless they are unsupported by substantial evidence. See 5 U.S.C. § 706(2)(E) (2000); Jazz Photo Corp. v. Int'l Trade Comm'n, 264 F.3d 1094, 1099 (Fed. Cir. 2001). "Substantial evidence" has been defined as "more than a mere scintilla" and as "such relevant evidence as a reasonable mind might accept as adequate to support a conclusion." Consol. Edison Co. v. NLRB, 305 U.S. 197, 229 (1938). We review the Commission's legal determinations de novo. See 5 U.S.C. § 706(2)(A) (2000); Finnigan Corp. v. Int'l Trade Comm'n, 180 F.3d 1354, 1361-62 (Fed. Cir. 1999). Claim construction is a legal determination that is reviewed de novo. Markman v. Westview Instruments, Inc., 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), aff'd, 517 U.S. 370 (1996). Likewise, a determination of whether a claim recites the subject matter which that applicant regards as his invention and is sufficiently definite, so as to satisfy the requirements of 35 U.S.C. § 112, ¶ 2, is a legal conclusion that is reviewed de novo. Solomon v. Kimberly-Clark Corp., 216 F.3d 1372, 1377 (Fed. Cir. 2000).

[47] B. Claim Construction & Definiteness

[48] "In construing claims, the analytical focus must begin and remain centered on the language of the claims themselves, for it is that language that the patentee chose to use to `particularly point[ ] out and distinctly claim[ ] the subject matter which the patentee regards as his invention.'" Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1331 (Fed. Cir. 2001) (quoting 35 U.S.C. § 112, ¶ 2); see generally Tex. Digital Sys., Inc. v. Telegenix Inc., 308 F.3d 1193, 1201-02 (Fed. Cir. 2002). The terms used in the claims bear a presumption that they mean what they say and have the ordinary meaning that would be attributed to those words by persons skilled in the relevant art. See CCS Fitness, Inc. v. Brunswick Corp., 288 F.3d 1359, 1366 (Fed. Cir. 2002). Moreover, unless compelled otherwise, a court will give a claim term the full range of its ordinary meaning as understood by persons skilled in the relevant art. See Rexnord Corp. v. Laitram Corp., 274 F.3d 1336, 1342 (Fed. Cir. 2001).

[49] If the court determines that a claim is not "amenable to construction," then the claim is invalid as indefinite under 35 U.S.C. § 112, ¶ 2. Exxon Research & Eng'g Co. v. United States, 265 F.3d 1371, 1375 (Fed. Cir. 2001). The definiteness requirement of § 112, ¶ 2 "focuses on whether the claims, as interpreted in view of the written description, adequately perform their function of notifying the public of the [scope of the] patentee's right to exclude." S3 Inc. v. nVIDIA Corp., 259 F.3d 1364, 1371-72 (Fed. Cir. 2001) (citing Solomon, 216 F.3d at 1379). It requires "that the claims be amenable to construction, however difficult that task may be." Exxon Research, 265 F.3d at 1375. Because a claim is presumed valid, a claim is indefinite only if the "claim is insolubly ambiguous, and no narrowing construction can properly be adopted." Id.

[50] Honeywell attacks both the finding of non-infringement and the finding of invalidity. Honeywell first argues that the Commission misconstrued the claim language; and that under a correct construction, summary determination of non-infringement was inappropriate. Honeywell then argues that after conducting a "narrowing, validity-saving [claim construction] choice" the claims are definite and the

Commission erroneously concluded otherwise.

[51] The claim construction dispute focuses on the claim term "melting point elevation" or MPE. Claims 1 and 7 require that after solidifying the spun yarn by passing it through a solidification zone, but before hot drawing the yarn to a specified total draw ratio, the solidified yarn must be withdrawn at a sufficient speed to form a crystalline, partially oriented yarn with a specified crystallinity and a specified MPE. Claim 14 requires that the yarn exhibit an MPE within a specified range after hot drawing the yarn. The claim construction dispute specifically focuses on whether the claims require any particular sample preparation method when determining the MPE.

[52] The written description expressly defines MPE as "the difference between the specimen melting point (M.P.) and the melting point (M.P.Q.) of a specimen after subsequent rapid liquid nitrogen quenching of an encapsulated [differential scanning calorimeter] sample from the melt." '976 patent, col. 5, ll. 2-6. However, neither the claims, the written description, nor the prosecution history reference any of the four sample preparation methods that can be used to measure the MPE. The Commission's final determination includes a finding of fact that the choice of sample preparation method is critical to discerning whether a particular product is made by a process that infringes the '976 patent claims. Commission Opinion, slip op. at 12. Honeywell does not challenge that finding on appeal.

[53] Without any reference to a sample preparation method, there are at least two possible constructions of the term-the "any one method" construction and the "all methods" construction. Honeywell suggests a third construction-that the MPE must be determined using the unpublished "ball method." Under the "any one method" construction, the claims would be satisfied if, during the relevant step in the production process, the melting point elevation fell within the claimed range using any one of the four known sample-preparation techniques. Thus, regardless which method the operator chooses-the cut, coil, restrained, or ball methods-the claim would be satisfied so long as any one sample preparation method produced the claimed measurement. Under the "all methods" construction, the claims would be satisfied only if, during the relevant step in the production process, the MPE fell within the claimed range using each of the four known sample-preparation techniques. Thus, producing a yarn according to the claims would require that, during the relevant production step, the MPE fell within the claimed range using the cut, coil, restrained, and ball methods. Under the "ball method" construction, the claims would be satisfied if the MPE fell within the claimed ranges using the ball method regardless of whether the claims are satisfied using any of the three other known methods.

[54] The intrinsic record does not compel a narrowing of the claim language to any one of the possible definitions. The claims, written description, and prosecution history do not mention the different sample preparation methods or provide sufficient clues to discern which methods are acceptable. The written description does mention the use of a Perkin-Elmer DSC and 2 mg specimen sample size, but that information does not lead one of ordinary skill in the art to a particular sample preparation method. For example, the cut method, coil method, and ball methods could each be performed in a Perkin-Elmer DSC with a 2 mg specimen sample size. Because the intrinsic record is devoid of meaningful references to those processes, the intrinsic record fails to "resolve any ambiguity in a disputed claim term." Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1583 (Fed. Cir. 1996).

[55] Honeywell's only support for its claim construction comes from the declaration testimony of its expert, Dr. Weigmann. Weigmann testified that one of ordinary skill in the art would conclude from the written description and the claims that the inventors contemplated the ball method as the only method of measuring the MPE. He criticized each of the three other tests. With respect to the coil method,

Weigmann stated that it was "not practical" because it would be difficult to make a 2 mg specimen sample long enough to coil around the tips of tweezers. He criticized the cut method as "less reproducible" and "less practical" because the yarn sample shrinks, causing alterations to the structure of the fiber and leading to inaccurate results. Weigmann further testified that while the restraining method was the most reproducible, one of skill in the art would not understand the term "melting point elevation" to refer to that method because it was not possible at the time of the application to use the restraining method with the conventional DSC equipment mentioned in the written description.

[56] The Commission points to extrinsic evidence to support its argument that one of skill in the art would not exclude the three published sample preparation methods in favor of the unpublished ball method. One prior art article of record describes preparing 1 to 2 mg PET yarn samples with two different "methods of sample placement," the cut method and the restrained method. See Arata Miyagi & Bernhard Wunderlich, Superheating and Reorganization of Melting of Poly(ethylene Terephthalate), 10 J. Polymer Sci.: Polymer Physics Ed. 1401, 1402 (1972). While that article refers to different measuring equipment than that specified in the '976 patent, the article supports the proposition that those skilled in the art used the cut and restrained methods at the time of the application of the '976 patent. The Commission also pointed to the Japanese Industrial Standard, Testing Methods for Transition Temperatures of Plastics K 7121 (1987), which outlined a sample preparation method for DSC testing using the cut method. Both Hyosung and the Commission note the absence in the record of any published documentation of the ball method outside of Honeywell's confidential files.

[57] After reviewing the entire record regarding claim construction, we agree with the Commission and hold that the claims are insolubly ambiguous, and hence indefinite, with respect to a required sample preparation method. As we discuss below with respect to each proffered construction, the claims, the written description, and the prosecution history fail to give us, as the interpreter of the claim term, any guidance as to what one of ordinary skill in the art would interpret the claim to require. Moreover, because the sample preparation method is critical to discerning whether a PET yarn has been produced by the claimed process, knowing the proper sample preparation method is necessary to practice the invention.

[58] 1. The "Ball Method Only" Construction

[59] Honeywell urges us to adopt the "ball method only" construction because that construction is the "validity saving choice." However, even if, as Weigmann suggests, the ball method were "more practical" than other methods, the intrinsic evidence cannot be construed to eliminate all other known methods of sample preparation. Honeywell's proffered construction is only supported by its expert's declaration. The cut method, coil method, and restraining method are well documented in technical publications and the prior art. The ball method, while perhaps known to some in the art, is only documented in proprietary Honeywell documents. Adopting Honeywell's proffered construction would require the court to import a limitation that is not only outside the bounds of the claims, the written description, and the prosecution history, but is also outside the scope of any written publication. We may not rewrite claims to preserve validity in that manner. Rhine v. Casio, Inc., 183 F.3d 1342, 1345 (Fed. Cir. 1999); Quantum Corp. v. Rodime, PLC, 65 F.3d 1577, 1584 (Fed. Cir. 1995) ("Although we construe claims, if possible, so as to sustain their validity, it is well settled that . . . courts do not redraft claims." (citations omitted)).

[60] 2. The "Any One Method" Construction

[61] Just as we cannot limit the term MPE to the "ball method only" construction, we cannot limit the construction of MPE to the "any one method" construction. Because the sample preparation method is critical in determining MPE, processes utilizing different sample preparation methods will produce different yarns. Without knowing which sample preparation method to use, one cannot discern whether a yarn was produced using the claimed process. Under the "any one method" construction, the testing results will necessarily fall within or outside the claim scope depending on the sample preparation method chosen. Competitors trying to practice the invention or to design around it would be unable to discern the bounds of the invention. See Morton Int'l v. Cardinal Chem. Co., 5 F.3d 1464, 1470 (Fed. Cir. 1993) (holding claims indefinite because one skilled in the art could not determine whether a given compound was within the scope of the claims).

[62] The criticality of sample preparation method also distinguishes this case from PPG Industries, Inc,. v. Guardian Industries Corp., 75 F.3d 1558 (Fed. Cir. 1996). In that case, PPG accused Guardian of infringing its patent directed to a glass composition consisting of different ingredients and exhibiting an ultraviolet transmittance within a certain range. PPG Indus., 75 F.3d at 1560-61. Guardian argued that the claims were indefinite because the written description failed to state the method the inventors used to measure the ultraviolet transmission of the invention. This court rejected that argument because "all of the conventional methods of testing ultraviolet transmittance produce essentially identical results." Id. at 1563. As such, the claims were "sufficiently definite to put the public on fair notice of what compositions fall within the scope of the claims." Id. Here, the different sample preparation methods do not produce identical or even "essentially identical results."

[63] 3. The "All Methods Construction"

[64] With respect to the final possible claim construction, the "all method" construction, Honeywell admits that such a construction would render the invention inoperable. While an inoperable claim construction would render the claim invalid for lack of enablement rather than for indefiniteness, see EMI Group N. Am., Inc. v. Cypress Semiconductor Corp., 268 F.3d 1342, 1348 (Fed. Cir. 2001), the claim is nevertheless invalid. Because the '976 patent claims are either indefinite or not enabled, the Commission correctly determined that Hyosung did not violate section 337 of the Tariff Act of 1930 by importing into the United States articles that "are made, produced, processed, or mined under, or by means of, a process covered by the claims of a valid and enforceable United States patent." 19 U.S.C. § 1337(a)(B)(ii) (2000) (emphasis added).

[65] C. Infringement

[66] Despite its holding that the claims were invalid, the Commission let stand the administrative law judge's finding that the claims were not infringed. A determination of infringement requires a two-step analysis. "First, the court determines the scope and meaning of the patent claims asserted . . . [and secondly,] the properly construed claims are compared to the allegedly infringing device." Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1454 (Fed. Cir. 1998) (en banc) (citations omitted). Because the claims are indefinite, the claims, by definition, cannot be construed. Exxon Research, 265 F.3d at 1375. Without a discernable claim construction, an infringement analysis cannot be performed. To the extent that the Commission attempted to perform an infringement analysis of indefinite claims, we vacate that finding as moot.

[67] CONCLUSION

[68] All claims of the '976 patent are invalid for failure to "particularly point[ ] out and distinctly claim[ ] the subject matter which the patentee regards as his invention." 35 U.S.C. § 112, ¶ 2. The Commission correctly held that Hyosung did not violate section 337 of the Tariff Act of 1930 by infringing a valid U.S. patent. Accordingly, we affirm.

[69] AFFIRMED

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[1] U.S. Court of Appeals, Federal Circuit

[2] No. 02-1393, -1448

[3] 341 F.3d 1332, 2003.CFC.0000197 <http://www.versuslaw.com>, 68 U.S.P.Q.2d 1023

[4] August 26, 2003

[5] **HONEYWELL INTERNATIONAL, INC., APPELLANT,**
v.
INTERNATIONAL TRADE COMMISSION, APPELLEE,
AND HYOSUNG CORPORATION AND HYOSUNG (AMERICA), INC., INTERVENORS.

[6] Appealed from: United States International Trade Commission

[7] Richard G. Taranto, Farr & Taranto, of Washington, Dc, argued for appellant. Of counsel on the brief were Raphael V. Lupo and Steven A. Maddox, McDermott, Will & Emery, of Washington, Dc.

[8] Jean H. Jackson, Attorney, Office of the General Counsel, U.S. International Trade Commission, of Washington, Dc, argued for appellee. With her on the brief were Lyn M. Schlitt, General Counsel; and Andrea C. Casson, Acting Deputy General Counsel. Of counsel was James M. Lyons, Attorney, U.S. International Trade Commission.

[9] Victor N. Balancia, Pennie & Edmonds Llp, of Washington, Dc, argued for intervenors. With him on the brief was Carl P. Bretscher. Of counsel on the brief were Steven I. Wallach and John C. Martin, Pennie & Edmonds Llp, of New York, New York. Of counsel were Marcia H. Sundeen, Paul Zegger, and Eric J. Fues, Pennie & Edmonds Llp, of Washington, Dc.

[10] Before Lourie, Gajarsa, and Linn, Circuit Judges.

[11] The opinion of the court was delivered by: Linn, Circuit Judge.

[12] Honeywell International Corporation ("Honeywell") appeals from the final determination of the United States International Trade Commission ("Commission") in Investigation No. 337-TA-457, which held that Hyosung Corporation of Seoul, Korea, and Hyosung (America), Incorporated (collectively "Hyosung") did not violate section 337 of the Tariff Act of 1930. In re Certain Polyethylene Terephthalate Yarn and Products Containing Same, USITC Investigation No. 337-TA-457, 2002 ITC LEXIS 665 (June 18, 2002) ("Commission Opinion"). The Commission specifically held that Honeywell's U.S. Patent No. 5,630,976 ("the '976 patent") was invalid as indefinite under 35 U.S.C. § 112, ¶ 2 and that certain polyethylene terephthalate yarns imported by Hyosung did not infringe the

between the specimen melting point (M.P.) and the melting point (M.P.Q.) of a specimen after subsequent rapid liquid nitrogen quenching of an encapsulated [differential scanning calorimeter] sample from the melt." Id. at col. 5, ll. 2-6. The written description recites one example of how to measure the MPE, including a sample size, the rate of temperature increase for performing the test, and the equipment to be used:

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[38] II.

[39] On May 17, 2001, the Commission instituted a patent-based investigation concerning the importation and sale of PET yarn and PET yarn-containing products. In this proceeding, Honeywell complained that

Hyosung was importing PET yarn and PET yarn-containing products produced by a process that infringed claims 1-2, 4-5, 7-8, 10-11, and 13-17 of the '976 patent in violation of section 337 of the Tariff Act of 1930. After the complaint was referred to an administrative law judge for an evidentiary hearing, Hyosung, supported by the Commission investigative attorney, moved for summary determination of non-infringement and invalidity of the '976 patent. Honeywell and Hyosung disputed, among other things, whether construction of the claims required the use of a particular sample preparation method. Honeywell argued that the claims must be construed to require measurement of the MPE using the ball method and not using the cut method, coil method, or restraining method. Hyosung did not offer a competing construction other than to argue that the claims should not be construed to specifically require the ball method.

[40] On February 4, 2002, the presiding administrative law judge issued the Initial Determination, a portion of which granted Hyosung's motion for summary determination of no infringement, and a portion of which denied Hyosung's motion as to patent invalidity. With respect to the claim construction issue, the administrative law judge held that "the term `melting point elevation' in the asserted claims of the '976 patent should be construed . . . to permit the measurement of melting points by means of any sample preparation method known to persons of ordinary skill in the art as of the earliest priority filing date of the '976 patent, which would include the cut method used by Hyosung." Id. at 26-27. Despite that broad construction, the administrative law judge then found that Hyosung did not infringe the asserted claims. Id. at 42. Furthermore, the administrative law judge held that Hyosung failed to prove by clear and convincing evidence that the claims at issue were invalid under 35 U.S.C. § 112, ¶¶ 1 and 2, due to indefiniteness, lack of enablement, or failure to provide an adequate written description. Id. Subsequently, Honeywell sought review from the Commission of the claim construction and the determination of non-infringement. Likewise, Hyosung and the Commission investigative attorney appealed the portion of the determination denying summary determination of invalidity.

[41] On March 21, 2002, the Commission declined to review the administrative law judge's determination of non-infringement. As such, the administrative law judge's initial determination became the final determination of the Commission. See 19 C.F.R. § 210.42(h) (2001). However, the Commission accepted the appeal of the denial of summary determination of invalidity, limiting its inquiry solely to the issue of indefiniteness under 35 U.S.C. § 112, ¶ 2.

[42] On appeal, the Commission reversed the administrative law judge's determination that Hyosung failed to prove by clear and convincing evidence that the claims were indefinite. Commission Opinion, slip. op. at 19. The Commission reasoned that "the published art of thermal analysis recognizes that the manner in which a PET yarn sample is prepared for testing affects the value of the melting point measurement obtained, and demonstrates that the practice in the art is to state which method of sample preparation is used." Id. at 16. Because the '976 patent's written description failed to disclose any particular method for PET yarn sample preparation, the Commission found "that the claims in issue are not `as precise as the subject matter permits,' particularly in view of the published literature in the field at the time of the filing of the '976 patent." Id. Thus, the Commission found those terms ambiguous and held that the claims were indefinite under 35 U.S.C. § 112, ¶ 2.

[43] In these consolidated appeals, Honeywell challenges the finding of non-infringement, arguing that the final determination rests upon a faulty claim construction. Honeywell also appeals the determination that the '976 patent is invalid. Hyosung filed a brief as intervenors. This court has jurisdiction pursuant to 28 U.S.C. § 1295(a)(6).

[44] DISCUSSION

[45] A. Standard of Review

[46] In appeals from the Commission under 28 U.S.C. § 1295(a)(6), the issue before this court is whether the Commission erred when determining whether a violation of section 337 of the Tariff Act of 1930 occurred. See 19 U.S.C. § 1337 (2000). We review the Commission's factual findings in accordance with the Administrative Procedure Act. See Id. § 1337(c). Such findings will be sustained unless they are unsupported by substantial evidence. See 5 U.S.C. § 706(2)(E) (2000); Jazz Photo Corp. v. Int'l Trade Comm'n, 264 F.3d 1094, 1099 (Fed. Cir. 2001). "Substantial evidence" has been defined as "more than a mere scintilla" and as "such relevant evidence as a reasonable mind might accept as adequate to support a conclusion." Consol. Edison Co. v. NLRB, 305 U.S. 197, 229 (1938). We review the Commission's legal determinations de novo. See 5 U.S.C. § 706(2)(A) (2000); Finnigan Corp. v. Int'l Trade Comm'n, 180 F.3d 1354, 1361-62 (Fed. Cir. 1999). Claim construction is a legal determination that is reviewed de novo. Markman v. Westview Instruments, Inc., 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), aff'd, 517 U.S. 370 (1996). Likewise, a determination of whether a claim recites the subject matter which that applicant regards as his invention and is sufficiently definite, so as to satisfy the requirements of 35 U.S.C. § 112, ¶ 2, is a legal conclusion that is reviewed de novo. Solomon v. Kimberly-Clark Corp., 216 F.3d 1372, 1377 (Fed. Cir. 2000).

[47] B. Claim Construction & Definiteness

[48] "In construing claims, the analytical focus must begin and remain centered on the language of the claims themselves, for it is that language that the patentee chose to use to `particularly point[ ] out and distinctly claim[ ] the subject matter which the patentee regards as his invention.'" Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1331 (Fed. Cir. 2001) (quoting 35 U.S.C. § 112, ¶ 2); see generally Tex. Digital Sys., Inc. v. Telegenix Inc., 308 F.3d 1193, 1201-02 (Fed. Cir. 2002). The terms used in the claims bear a presumption that they mean what they say and have the ordinary meaning that would be attributed to those words by persons skilled in the relevant art. See CCS Fitness, Inc. v. Brunswick Corp., 288 F.3d 1359, 1366 (Fed. Cir. 2002). Moreover, unless compelled otherwise, a court will give a claim term the full range of its ordinary meaning as understood by persons skilled in the relevant art. See Rexnord Corp. v. Laitram Corp., 274 F.3d 1336, 1342 (Fed. Cir. 2001).

[49] If the court determines that a claim is not "amenable to construction," then the claim is invalid as indefinite under 35 U.S.C. § 112, ¶ 2. Exxon Research & Eng'g Co. v. United States, 265 F.3d 1371, 1375 (Fed. Cir. 2001). The definiteness requirement of § 112, ¶ 2 "focuses on whether the claims, as interpreted in view of the written description, adequately perform their function of notifying the public of the [scope of the] patentee's right to exclude." S3 Inc. v. nVIDIA Corp., 259 F.3d 1364, 1371-72 (Fed. Cir. 2001) (citing Solomon, 216 F.3d at 1379). It requires "that the claims be amenable to construction, however difficult that task may be." Exxon Research, 265 F.3d at 1375. Because a claim is presumed valid, a claim is indefinite only if the "claim is insolubly ambiguous, and no narrowing construction can properly be adopted." Id.

[50] Honeywell attacks both the finding of non-infringement and the finding of invalidity. Honeywell first argues that the Commission misconstrued the claim language; and that under a correct construction, summary determination of non-infringement was inappropriate. Honeywell then argues that after conducting a "narrowing, validity-saving [claim construction] choice" the claims are definite and the

Commission erroneously concluded otherwise.

[51] The claim construction dispute focuses on the claim term "melting point elevation" or MPE. Claims 1 and 7 require that after solidifying the spun yarn by passing it through a solidification zone, but before hot drawing the yarn to a specified total draw ratio, the solidified yarn must be withdrawn at a sufficient speed to form a crystalline, partially oriented yarn with a specified crystallinity and a specified MPE. Claim 14 requires that the yarn exhibit an MPE within a specified range after hot drawing the yarn. The claim construction dispute specifically focuses on whether the claims require any particular sample preparation method when determining the MPE.

[52] The written description expressly defines MPE as "the difference between the specimen melting point (M.P.) and the melting point (M.P.Q.) of a specimen after subsequent rapid liquid nitrogen quenching of an encapsulated [differential scanning calorimeter] sample from the melt." '976 patent, col. 5, ll. 2-6. However, neither the claims, the written description, nor the prosecution history reference any of the four sample preparation methods that can be used to measure the MPE. The Commission's final determination includes a finding of fact that the choice of sample preparation method is critical to discerning whether a particular product is made by a process that infringes the '976 patent claims. Commission Opinion, slip op. at 12. Honeywell does not challenge that finding on appeal.

[53] Without any reference to a sample preparation method, there are at least two possible constructions of the term-the "any one method" construction and the "all methods" construction. Honeywell suggests a third construction-that the MPE must be determined using the unpublished "ball method." Under the "any one method" construction, the claims would be satisfied if, during the relevant step in the production process, the melting point elevation fell within the claimed range using any one of the four known sample-preparation techniques. Thus, regardless which method the operator chooses-the cut, coil, restrained, or ball methods-the claim would be satisfied so long as any one sample preparation method produced the claimed measurement. Under the "all methods" construction, the claims would be satisfied only if, during the relevant step in the production process, the MPE fell within the claimed range using each of the four known sample-preparation techniques. Thus, producing a yarn according to the claims would require that, during the relevant production step, the MPE fell within the claimed range using the cut, coil, restrained, and ball methods. Under the "ball method" construction, the claims would be satisfied if the MPE fell within the claimed ranges using the ball method regardless of whether the claims are satisfied using any of the three other known methods.

[54] The intrinsic record does not compel a narrowing of the claim language to any one of the possible definitions. The claims, written description, and prosecution history do not mention the different sample preparation methods or provide sufficient clues to discern which methods are acceptable. The written description does mention the use of a Perkin-Elmer DSC and 2 mg specimen sample size, but that information does not lead one of ordinary skill in the art to a particular sample preparation method. For example, the cut method, coil method, and ball methods could each be performed in a Perkin-Elmer DSC with a 2 mg specimen sample size. Because the intrinsic record is devoid of meaningful references to those processes, the intrinsic record fails to "resolve any ambiguity in a disputed claim term." Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1583 (Fed. Cir. 1996).

[55] Honeywell's only support for its claim construction comes from the declaration testimony of its expert, Dr. Weigmann. Weigmann testified that one of ordinary skill in the art would conclude from the written description and the claims that the inventors contemplated the ball method as the only method of measuring the MPE. He criticized each of the three other tests. With respect to the coil method,

[61] Just as we cannot limit the term MPE to the "ball method only" construction, we cannot limit the construction of MPE to the "any one method" construction. Because the sample preparation method is critical in determining MPE, processes utilizing different sample preparation methods will produce different yarns. Without knowing which sample preparation method to use, one cannot discern whether a yarn was produced using the claimed process. Under the "any one method" construction, the testing results will necessarily fall within or outside the claim scope depending on the sample preparation method chosen. Competitors trying to practice the invention or to design around it would be unable to discern the bounds of the invention. See Morton Int'l v. Cardinal Chem. Co., 5 F.3d 1464, 1470 (Fed. Cir. 1993) (holding claims indefinite because one skilled in the art could not determine whether a given compound was within the scope of the claims).

[62] The criticality of sample preparation method also distinguishes this case from PPG Industries, Inc,. v. Guardian Industries Corp., 75 F.3d 1558 (Fed. Cir. 1996). In that case, PPG accused Guardian of infringing its patent directed to a glass composition consisting of different ingredients and exhibiting an ultraviolet transmittance within a certain range. PPG Indus., 75 F.3d at 1560-61. Guardian argued that the claims were indefinite because the written description failed to state the method the inventors used to measure the ultraviolet transmission of the invention. This court rejected that argument because "all of the conventional methods of testing ultraviolet transmittance produce essentially identical results." Id. at 1563. As such, the claims were "sufficiently definite to put the public on fair notice of what compositions fall within the scope of the claims." Id. Here, the different sample preparation methods do not produce identical or even "essentially identical results."

[63] 3. The "All Methods Construction"

[64] With respect to the final possible claim construction, the "all method" construction, Honeywell admits that such a construction would render the invention inoperable. While an inoperable claim construction would render the claim invalid for lack of enablement rather than for indefiniteness, see EMI Group N. Am., Inc. v. Cypress Semiconductor Corp., 268 F.3d 1342, 1348 (Fed. Cir. 2001), the claim is nevertheless invalid. Because the '976 patent claims are either indefinite or not enabled, the Commission correctly determined that Hyosung did not violate section 337 of the Tariff Act of 1930 by importing into the United States articles that "are made, produced, processed, or mined under, or by means of, a process covered by the claims of a valid and enforceable United States patent." 19 U.S.C. § 1337(a)(B)(ii) (2000) (emphasis added).

[65] C. Infringement

[66] Despite its holding that the claims were invalid, the Commission let stand the administrative law judge's finding that the claims were not infringed. A determination of infringement requires a two-step analysis. "First, the court determines the scope and meaning of the patent claims asserted . . . [and secondly,] the properly construed claims are compared to the allegedly infringing device." Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1454 (Fed. Cir. 1998) (en banc) (citations omitted). Because the claims are indefinite, the claims, by definition, cannot be construed. Exxon Research, 265 F.3d at 1375. Without a discernable claim construction, an infringement analysis cannot be performed. To the extent that the Commission attempted to perform an infringement analysis of indefinite claims, we vacate that finding as moot.

[67] CONCLUSION

[68] All claims of the '976 patent are invalid for failure to "particularly point[ ] out and distinctly claim[ ] the subject matter which the patentee regards as his invention." 35 U.S.C. § 112, ¶ 2. The Commission correctly held that Hyosung did not violate section 337 of the Tariff Act of 1930 by infringing a valid U.S. patent. Accordingly, we affirm.

[69] AFFIRMED

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[1] U.S. Court of Appeals, Federal Circuit

[2] 00-5077

[3] 265 F.3d 1371, 2001.CFC.0000520 <http://www.versuslaw.com>, 60 U.S.P.Q.2d 1272

[4] September 19, 2001

[5] **EXXON RESEARCH AND ENGINEERING COMPANY, PLAINTIFF-APPELLANT,**
v.
UNITED STATES, DEFENDANT-APPELLEE.

[6] E. Edward Bruce, Covington & Burling, of Washington, Dc, argued for plaintiff-appellant. With him on the brief were Christopher N. Sipes, and Kevin C. Newsom. Of counsel on the brief were Steven D. Glazer, James W. Quinn, Kevin McMahon, and Elizabeth S. Weiswasser, Weil, Gotshal & Manges Llp, of New York, New York. Of counsel were Matthew D. Powers, David J. Lender, and Peter Tu, Weil Gotshal & Manges, Llp. Grace S. Karaffa, Attorney, Commercial Litigation Branch, Civil Division, Department of Justice, of Washington, Dc, argued for defendant-appellee. With her on the brief was Vito J. DiPietro, Director. Of counsel on the brief were Thomas J. Byrnes, Richard T. Ruzich, and Ken B. Barrett, Attorneys.

[7] Before Mayer, Chief Judge, Lourie and Bryson, Circuit Judges.

[8] The opinion of the court was delivered by: Bryson, Circuit Judge

[9] Appealed from: United States Court of Federal Claims Judge Edward J. Damich

[10] Exxon Research and Engineering Co. is the assignee of U.S. Patent Nos. 5,292,705 ("the '705 patent") and 5,348,982 ("the '982 patent"), which are directed to improvements in a method for converting natural gas into liquid hydrocarbon products. Exxon brought suit against the United States in the Court of Federal Claims, asserting that the government infringed the '705 and '982 patents by authorizing Department of Energy subcontractors to use conversion methods covered by the patents. The government filed a motion for summary judgment seeking to have both patents held invalid for indefiniteness. In a detailed and careful opinion, the Court of Federal Claims granted the government's motion, and Exxon appealed. We conclude that, although this case presents several close questions, the claims at issue are not invalid for indefiniteness. Accordingly, we reverse the court's judgment of invalidity with respect to the two Exxon patents and remand the case for further proceedings.

[11] I.

[12] The '705 and '982 patents relate to improvements in what is known as the Fischer-Tropsch process for converting natural gas to liquid hydrocarbon products. As the process is described in the patents, natural gas is first broken down to produce synthesis gas (carbon monoxide and hydrogen). The synthesis gas is then introduced into a slurry bubble column where it undergoes the Fischer-Tropsch reaction.

[13] In the slurry bubble column, catalytic particles are suspended in liquid hydrocarbons. Gas phase reactants, including the synthesis gas, are then bubbled through the reactor. As the gas bubbles rise, the reactants are absorbed into the liquid and diffuse to the catalyst where they are converted to liquid hydrocarbon products.

[14] A.

[15] The '705 patent is directed to a method of activating an essentially fresh, reduced cobalt-containing Fischer-Tropsch catalyst. According to the specification, the cobalt catalyst is incorporated into an inert support material such as an inorganic refractory oxide.

[16] Because cobalt can be dangerous to handle, the supported cobalt catalyst is then typically heated in air to form an inactive cobalt oxide. The cobalt oxide must then be "reduced" to active cobalt metal before it is introduced into the slurry bubble column reactor. That is conventionally done by treating the cobalt oxide with hydrogen or hydrogen-containing gas at elevated temperatures or pressures. The specification teaches that the essentially fresh, reduced cobalt catalyst can then be "super activated" in a way that accelerates the conversion of the natural gas components into liquid hydrocarbons if the cobalt is further treated with hydrogen or a hydrogen-containing gas after the catalyst is introduced into the slurry bubble column reactor.

[17] The super-activation procedure is conducted either before synthesis gas is introduced into the reactor or shortly after the synthesis reaction has begun. The '705 patent states that the claimed treatment method increases the relative catalyst productivity in the Fischer-Tropsch reaction by at least 30%. '705 patent, col. 1, ll. 59-64. The '705 patent claims:

[18] 1. A method for activating an essentially fresh, reduced cobalt containing Fischer-Tropsch catalyst which comprises treating the catalyst with hydrogen or a hydrogen containing gas in the presence of hydrocarbon liquids for a period sufficient to increase substantially the initial catalyst productivity.

[19] All other claims of the '705 patent depend from claim 1.

[20] In its motion for summary judgment, the government asserted that the terms "for a period sufficient" and "to increase substantially" in claim 1 of the '705 patent were both indefinite. The Court of Federal Claims agreed with the government's submission and therefore held the '705 patent invalid.

[21] B.

[22] The '982 patent teaches a method for optimally operating a slurry bubble column using a supported

cobalt catalyst to produce hydrocarbon products at an increased rate. This result is achieved by controlling certain reactor variables. Claim 1 of the '982 patent recites:

[23] 1. A method for optimally operating a large diameter three phase (gas, liquid, solid) slurry bubble column having a diameter greater than 15 cm for Fischer-Tropsch synthesis over a supported cobalt catalyst in which solid particles are fluidized in the liquid phase by bubbles of the gas phase, comprising:

[24] (a) injecting the gas phase into said column at an average gas velocity along said column, Ug > 2 cm/sec, such that the flow regime is in the substantial absence of slug flow;

[25] (b) fluidizing the solid supported cobalt catalyst particles of average diameter, dp > 5 um, to the height, H > 3m, of the expanded liquid in the column by operating with a catalyst settling velocity, Us, and dispersion coefficient, D, such that

[26] 0.5 (Us - UL) 3 m

[27] where

[28] US = 1/18 dp1 Ps - Pi/ul g f(Cp), where dp > 5 um

[29] and

[30] (c) maintaining plug flow in said column by operating with a gas phase velocity, Ug, expanded liquid height, H, and dispersion coefficient, D, such that Ug = 0.2D/H, where H > 3m, Ug > 2 cm/sec

[31] wherein

[32] Ps = effective density of the particles

[33] Pl = density of the liquid

[34] u = viscosity of the liquid

[35] f(Cp) = hindered settling function

[36] = volume fraction of solids in the slurry (liquid plus solids)

[37] UL = liquid velocity along the column

[38] H = height of the expanded liquid in said reactor

[39] g = gravitational constant

[40] dp = diameter of particles

[41] m = meters.

[42] All other claims of the '982 patent depend from claim 1.

[43] On the government's motion for summary judgment, the Court of Federal Claims found that four of the terms in claim 1 of the '982 patent were indefinite and that claim 1 and all the dependent claims were therefore invalid. The four terms that the court found to be indefinite are: "substantial absence of slug flow," "fluidizing the . . . catalyst particles . . . to the height, H > 3m," "particles of average diameter," and the term "UL" as used in the first formula set out in claim 1.

[44] II.

[45] A.

[46] Section 112 paragraph 2 of the Patent Act requires that a patent specification conclude with one or more claims "particularly pointing out and distinctly claiming subject matter which the applicant regards as his invention." 35 U.S.C. § 112, ¶ 2. We have stated the standard for assessing whether a patent claim is sufficiently definite to satisfy the statutory requirement as follows: If one skilled in the art would understand the bounds of the claim when read in light of the specification, then the claim satisfies section 112 paragraph 2. Miles Labs., Inc. v. Shandon, Inc., 997 F.2d 870, 875, 27 USPQ2d 1123, 1126 (Fed. Cir. 1993).

[47] While that standard is easy to state, it has not always proved easy to apply. The Supreme Court explained the reason underlying the indefiniteness doctrine 60 years ago in United Carbon Co. v. Binney & Smith Co., 317 U.S. 228, 236, 55 USPQ 381, 385 (1942):

[48] A zone of uncertainty which enterprise and experimentation may enter only at the risk of infringement claims would discourage invention only a little less than unequivocal foreclosure of the field. Moreover, the claims must be reasonably clear-cut to enable courts to determine whether novelty and invention are genuine.

[49] In determining whether that standard is met, i.e., whether "the claims at issue [are] sufficiently precise to permit a potential competitor to determine whether or not he is infringing," Morton Int'l, Inc. v. Cardinal

Chem. Co., 5 F.3d 1464, 1470, 28 USPQ2d 1190, 1195 (Fed. Cir. 1993), we have not held that a claim is indefinite merely because it poses a difficult issue of claim construction. We engage in claim construction every day, and cases frequently present close questions of claim construction on which expert witnesses, trial courts, and even the judges of this court may disagree. Under a broad concept of indefiniteness, all but the clearest claim construction issues could be regarded as giving rise to invalidating indefiniteness in the claims at issue. But we have not adopted that approach to the law of indefiniteness. We have not insisted that claims be plain on their face in order to avoid condemnation for indefiniteness; rather, what we have asked is that the claims be amenable to construction, however difficult that task may be. If a claim is insolubly ambiguous, and no narrowing construction can properly be adopted, we have held the claim indefinite.

[50] If the meaning of the claim is discernible, even though the task may be formidable and the conclusion may be one over which reasonable persons will disagree, we have held the claim sufficiently clear to avoid invalidity on indefiniteness grounds. See, e.g., Modine Mfg. Co. v. U.S. Int'l Trade Comm'n, 75 F.3d 1545, 1557, 37 USPQ2d 1609, 1617 (Fed. Cir. 1996) (rejecting indefiniteness argument after construing claims; stating that "when claims are amenable to more than one construction, they should when reasonably possible be interpreted to preserve their validity"); Athletic Alternatives, Inc. v. Prince Mfg., Inc., 73 F.3d 1573, 1581, 37 USPQ2d 1365, 1372 (Fed. Cir. 1996) (court chose the narrower of two equally plausible claim constructions in order to avoid invalidating the claim). By finding claims indefinite only if reasonable efforts at claim construction prove futile, we accord respect to the statutory presumption of patent validity, see N. Am. Vaccine, Inc. v. Am. Cyanamid Co., 7 F.3d 1571, 1579, 28 USPQ2d 1333, 1339 (Fed. Cir. 1993), and we protect the inventive contribution of patentees, even when the drafting of their patents has been less than ideal.

[51] B.

[52] A decision holding a patent invalid for indefiniteness presents a question of law, which we review de novo. See Atmel Corp. v. Info. Storage Devices, Inc., 198 F.3d 1374, 1378, 53 USPQ2d 1225, 1227 (Fed. Cir. 2000). Despite a multitude of recent authorities stating that indefiniteness is a question of law, see, e.g., S3 Inc. v. nVIDIA Corp., No. 00-1257, slip. op. at 4 (Fed. Cir. Aug. 3, 2001); Union Pac. Res. Co. v. Chesapeake Energy Corp., 236 F.3d 684, 692, 57 USPQ2d 1293, 1297 (Fed. Cir. 2001); Process Control Corp. v. Hydreclaim Corp., 190 F.3d 1350, 1358 n.2, 52 USPQ2d 1029, 1034 n.2 (Fed. Cir. 1999); Solomon v. Kimberly-Clark Corp., 216 F.3d 1372, 1377, 55 USPQ2d 1279, 1281 (Fed. Cir. 2000); and Personalized Media Communications, L.L.C. v. Int'l Trade Comm'n, 161 F.3d 696, 702, 48 USPQ2d 1880, 1886 (Fed. Cir. 1998), Exxon contends that indefiniteness depends on underlying questions of fact.

[53] It argues that in this case there is a genuine issue of material fact as to whether the claims of the two patents at issue, read in light of their specifications, reasonably apprise those skilled in the art of the scope of the invention. For that reason, Exxon asks us to reverse the summary judgment so that the Court of Federal Claims, sitting as a fact- finder at trial, can decide the purported factual issues and reconsider its prior invalidity determination.

[54] We adhere to the principle that "determination of claim indefiniteness is a legal conclusion that is drawn from the court's performance of its duty as the construer of patent claims." Personalized Media Communications, 161 F.3d at 705, 48 USPQ2d at 1888; see also Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1454-55, 46 USPQ2d 1169, 1172-73 (Fed. Cir. 1998) (en banc). In Cybor, we reaffirmed that although a court may consider or reject certain extrinsic evidence in resolving disputes en route to

pronouncing the meaning of claim language, "the court is not crediting certain evidence over other evidence or making factual evidentiary findings. Rather, the court is looking to the extrinsic evidence to assist in its construction of the written document . . . ." Cybor, 138 F.3d at 1454, 46 USPQ2d at 1173 (quoting Markman v. Westview Instruments, Inc., 52 F.3d 967, 981, 34 USPQ2d 1321, 1331 (Fed. Cir. 1995) (en banc)). We therefore reject Exxon's argument that the issue of indefiniteness turns on an underlying factual dispute that should not have been resolved as a matter of law on summary judgment.

[55] C.

[56] The trial court was correct to fault the Exxon patents as lacking in specificity in several respects-specificity that in some instances would have been easy to provide and would have largely obviated the need to address the issue of indefiniteness. As is often the case when problems in document drafting lead to litigation, the ideal of precision was not achieved here, and we are left to deal with an imperfect product. While we agree with the trial court that the product was less than perfect, we disagree that the flaws were fatal.

[57] III.

[58] The trial court held claim 1 of the '705 patent to be indefinite based on the absence of a specified period of time in the claim for treating the Fischer-Tropsch catalyst with hydrogen or a hydrogen- containing gas. The claim recites that the treatment should be "for a period sufficient to increase substantially the initial catalyst activity." The trial court broke that clause down into two parts for purposes of its indefiniteness analysis, and it ruled that both the phrase "for a period sufficient" and the phrase "to increase substantially" were indefinite.

[59] A.

[60] The term "to increase substantially" in claim 1 of the '705 patent refers to the claimed increase achieved by the invention in the relative productivity of the catalyst used in the Fischer-Tropsch process. The specification defines "substantially increased" catalyst activity or productivity as an increase of at least about 30%, more preferably an increase of about 50%, and still more preferably an increase of about 75%. '705 patent, col. 1, ll. 59-63. Based on that language from the specification, the trial court found, and the parties agree, that the term "to increase substantially" requires an increase of at least about 30% in the relative productivity of the catalyst. Notwithstanding that numerical boundary, the trial court found the phrase "to increase substantially" to be indefinite because the court concluded that there were two possible ways to calculate the increase in productivity, the subtraction method and the division method, and the patent did not make clear which of those ways was used in the claim.

[61] An example from the specification will illustrate the difference between the two methods of calculating the increase in catalyst productivity. The specification gives two examples showing the relative productivity "before" and "after" super-activation according to the method of the invention. In the experiment reported in Example 1, the "before" productivity was 60 and the "after" productivity was 100. In the experiment reported in Example 2, the "before" productivity was 25 and the "after" productivity was 100. The court found that the increase in relative productivity could be calculated either by the subtraction method or the division method. That is, in Example 2 there would be either a 75% increase (100 minus 25) or a 300% increase ([100 minus 25] divided by 25). The difference in the

numerical outcome produced by the two results is relevant because in certain circumstances calculating relative productivity by the first method could produce an increase of less than 30% in relative productivity, but using the second method could produce an increase of more than 30%. In such a case, the trial court explained, a person of skill in the art would not be able to determine whether the claims of the '705 patent were infringed. That ambiguity, according to the court, rendered the claims indefinite.

[62] We disagree with the court's conclusion as to the indefiniteness of the phrase "to increase substantially." The specification makes it reasonably clear that the patentee intended to use the subtraction method in calculating relative productivity. As noted above, the specification recites that catalyst productivity can "more preferably" be increased by as much as 75%. Corresponding to that preferable level of increased productivity, the best result reported in the patent is found in Example 2, which shows an increase in relative productivity from 25% to 100%, which is an increase of 75% by the subtraction method.

[63] The same result is shown graphically in Figure 1 of the patent, which depicts a 75% difference between the "before" and "after" relative productivity levels, as calculated by the subtraction method. In contrast, there is no suggestion in the specification that the claimed invention was able to achieve increases on the order of 300%, which would be the way the Figure 1 increase would be characterized if the division method were used. In light of the intrinsic evidence, one of skill in the art would likely understand that the patentee employed the subtraction method of measuring the increase in relative productivity.

[64] Thus, the term "to increase substantially" does not introduce any insoluble ambiguity into the claims of the '705 patent and does not render the claims invalid for indefiniteness.

[65] B.

[66] The trial court also found that the "for a period sufficient" limitation in claim 1 of the '705 patent was indefinite and that it rendered claim 1 and the dependent claims of the '705 patent invalid. The court based that conclusion on the fact that neither the claims nor the specification identified any upper or lower boundary for the prescribed period. Without such boundaries, the court concluded, a person of ordinary skill in the art could not determine the scope of the claims.

[67] Although the specification teaches away from treating the cobalt catalyst for a period longer than necessary to obtain maximum activity enhancement, see '705 patent, col. 3, ll. 21-23, the claims are not indefinite on the ground that they fail to recite an upper boundary for the "for a period sufficient" limitation. The claims provide that the catalyst must be treated "for a period sufficient" to attain a 30% increase in catalyst productivity. That limitation sets the minimum period of treatment, but any longer period would also fall within the reach of the claim language. Thus, the "period sufficient" limitation by its terms delineates only a lower boundary. While treatment of the catalyst for a much longer period might not be as effective as treatment for a period barely sufficient to achieve the prescribed increase in catalyst productivity, the fact that the invention may be inoperable with very long treatment periods does not make the claim language indefinite. See N. Am. Vaccine, 7 F.3d at 1579, 28 USPQ2d at 1339 (the fact that claims "include species which might not meet the objects of the invention does not by itself prove that one skilled in the art cannot ascertain the scope of the asserted claims"). The indefiniteness issue thus turns on whether the lower boundary of the "for a period sufficient" limitation is impermissibly vague.

[68] The trial court rejected Exxon's contention that the lower boundary could be ascertained by conducting activity checks during the super- activation procedure. The court noted that the patent taught the use of such checks only to determine the initial activity of the fresh catalyst, and that conducting activity checks to determine whether the catalyst has been sufficiently exposed would risk corrupting the catalyst and would significantly disrupt the super-activation procedure.

[69] In addition, the court rejected Exxon's alternative argument that the claim term "a period sufficient" is as definite as possible given the varying conditions, including temperature and treat ratio.

[70] Although the patent does not quantify the "period sufficient" limitation by reference to any specific period or range of periods, it does not leave those skilled in the art entirely without guidance as to the scope of that requirement. The specification states:

[71] The period necessary for activation is that period that results in substantial increases in initial, e.g., start of run, catalyst productivity, preferably at least about a thirty percent (30%) increase in relative catalyst productivity and may vary with temperature and treat ratio, etc., but is usually accomplished in about 0.25-24 hours, preferably about 0.5-2 hours. '705 patent, col. 2, ll. 58-64.

[72] As the trial court noted, the specification does not give a specific example of a period of time sufficient to achieve a particular increase in catalyst productivity for a certain supported catalyst. However, a preferred treatment period is provided that presumptively correlates to the preferred catalyst, hydrogen treat rate range, and temperature range disclosed in the specification. By looking to the specification, one of skill in the art could determine that "a period sufficient" is about 0.25 hours, and preferably 0.5 hours. Because the patent makes clear that the period in question will vary with changes in the catalyst and the conditions in which the process is run, we conclude that the claim limitation is expressed in terms that are reasonably precise in light of the subject matter. See Orthokinetics, Inc. v. Safety Travel Chairs, Inc., 806 F.2d 1565, 1576, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986) (construing "so dimensioned" as definite and stating that the term "is as accurate as the subject matter permits, automobiles being of various sizes").

[73] In addition, it appears that one of skill in the art could measure the period "sufficient to increase substantially the initial catalyst activity" for a particular catalyst more precisely by conducting activity checks. As the trial court noted, conducting such checks could contaminate the catalyst or disrupt the super-activation procedure.

[74] However, that does not mean that the data collected would be any less relevant in determining the scope of the claim. Once the "period sufficient" for a particular catalyst is determined, there would be no need to duplicate the activity checks during normal slurry bubble column reactor operations, and there would be no continuing risk of contamination or disruption. Even the government's expert agreed that the "period sufficient" could be determined from conducting such checks, and that he "wouldn't say they are difficult to do." Provided that the claims are enabled, and no undue experimentation is required, the fact that some experimentation may be necessary to determine the scope of the claims does not render the claims indefinite. See W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1557, 220 USPQ 303, 316 (Fed. Cir. 1983).

[75] Our predecessor court's decision in In re Jolly, 172 F.2d 566, 80 USPQ 504 (CCPA 1949), although

offering support to the government's position, does not compel a contrary result. In re Jolly concerned an indefiniteness rejection based on similar claim language, "a time sufficient to produce a substantially homogeneous product but insufficient to cause the formation of a substantial proportion of oil- insoluble reaction products." The court there found that since the time of reaction was taught to be critical, the claims must recite a time range for the sulfurization step at issue. While an upper time limit was recited, at least in some claims and in the written description, there was no lower limit recited. For that reason, the court affirmed the examiner's rejection, stating that "[s]o far as the time of reaction is concerned, it seems to us that all that appellant's specification teaches those skilled in the art is to experiment and find out for themselves how much time will be required where different amounts, or proportions, of nitriles and sulfur are used." In re Jolly, 172 F.2d at 569, 80 USPQ at 506.

[76] In re Jolly is admittedly quite similar in some respects to this case. In Jolly, however, it appears that there was no lower boundary recited in the applicant's specification, while in this case the patentee has stated that the catalyst should be treated for about 0.25 hours, and preferably 0.5 hours. Moreover, the specification in Jolly taught that reaction time was critical to the patentability of the invention, and the court emphasized that point in holding the claim language indefinite. There is no equivalent representation as to the criticality of the treatment period in this case, and in a post-Jolly decision, the Court of Customs and Patent Appeals explained that it is not fatal for an applicant to express noncritical limitations with regard to factors such as time or quantity in functional rather than numerical terms. In re Caldwell, 319 F.2d 254, 258, 138 USPQ 243, 246- 47 (CCPA 1963) (upholding claim language that referred to the amount of aspirin to be used in a method for stimulating growth in certain animals as "an effective amount . . . for growth stimulation"). Finally, Jolly was a case in which the court was reviewing the rejection of a patent application, not an infringement action based on an issued patent.

[77] Patent applicants have the opportunity to amend their claims during prosecution in order to overcome an indefiniteness rejection. See In re Zletz, 893 F.2d 319, 322, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989) ("[D]uring patent prosecution when claims can be amended, ambiguities should be recognized, scope and breadth of language explored, and clarification imposed. . . . An essential purpose of patent examination is to fashion claims that are precise, clear, correct, and unambiguous.

[78] Only in that way can uncertainties of claim construction be removed, as much as possible, during the administrative process."). That factor explains, for example, the practice of construing claims according to their broadest reasonable interpretation consistent with the specification where the patent has not yet issued and the applicant has an opportunity to amend the claim to avoid invalidity. See, e.g., In re Wiggins, 488 F.2d 538, 541-42, 179 USPQ 421, 423-24 (CCPA 1973).

[79] Unlike the applicant in Jolly, Exxon has the benefit of a statutory presumption of validity, 35 U.S.C. § 282. In light of that presumption and the difference in posture between an applicant whose application has been rejected and a patentee with an issued patent, close questions of indefiniteness in litigation involving issued patents are properly resolved in favor of the patentee. Thus, in cases subsequent to In re Jolly that have involved issued patents, this court has held claims definite even when some degree of experimentation was necessary, as long as the claims otherwise met the enablement requirement. See, e.g., Chiuminatta Concrete Concepts, Inc. v. Cardinal Indus., 145 F.3d 1303, 1312, 46 USPQ2d 1752, 1759 (Fed. Cir. 1998) (holding that the recitation of a quantitative drop rod test rendered definite a claim limitation); W.L. Gore & Assocs., 721 F.2d at 1557, 220 USPQ at 316. The government's expert admitted that the "period sufficient" can be ascertained by conducting activity checks. Therefore, a person of ordinary skill in the art would understand the scope of that claim limitation, which is all that paragraph 2 of section 112 requires.

[80] Because we hold that the terms "for a period sufficient" and "to increase substantially" are not indefinite, we reverse the Court of Federal Claims' summary judgment of invalidity as to the '705 patent.

[81] IV.

[82] The trial court invalidated claim 1 of the '982 patent (and therefore also the remaining dependent claims of that patent) based on its conclusion that four of the terms used in that claim were indefinite. Upon close analysis of the claim language in the context of the written description of the '982 patent, we are persuaded that none of the four terms introduces sufficient uncertainty into the claim to compel its invalidation.

[83] A.

[84] The trial court found the term "substantial absence of slug flow" to be indefinite because the specification did not provide any empirical standard for determining when the process could be said to be substantially lacking in slug flow. A slug is a large gas bubble that forms in a slurry bubble column reactor and extends across the full width of the column. It is understood in the art that slugs may adversely affect reactor performance and efficiency. '982 patent, col. 8, ll. 29-33 (noting that small gas bubbles give better mass transfer performance). Exxon therefore argued to the trial court, and argues to us, that a "substantial absence of slug flow" in the '982 patent means that there is no "appreciable degree of gas slugs that would adversely impact performance of the claimed reactor." The trial court, however, found that definition to be insufficiently precise to save the patent from invalidation on the ground of indefiniteness.

[85] This court has stated that the fact that "some claim language may not be precise . . . does not automatically render a claim invalid. When a word of degree is used the district court must determine whether the patent's specification provides some standard for measuring that degree." Seattle Box Co. v. Indus. Crating & Packaging, Inc., 731 F.2d 818, 826, 221 USPQ 568, 574 (Fed. Cir. 1984).

[86] The '982 patent specification teaches that slug flow should be avoided because it may interfere with reactor operations. It is for that reason that the claims require a substantial absence of slug flow, or substantially zero slug flow. One of skill in the art would understand from the specification that the reason slug flow should be avoided is that it may interfere with reactor efficiency. Whether there is a "substantial absence of slug flow" therefore can be determined with reference to whether reactor efficiency is materially affected. If there is no slug flow or such minimal slug flow that the slug flow has no appreciable impact on reactor efficiency, then there is a "substantial absence of slug flow" within the meaning of the claims. In this setting, as in others, mathematical precision is not required-only a reasonable degree of particularity and definiteness. See Modine Mfg., 75 F.3d at 1557, 37 USPQ2d at 1617. We agree with Exxon that in light of the reasons for minimizing slug flow described in the specification, the "substantial absence" limitation does not render the '982 patent invalid for indefiniteness.

[87] B.

[88] The trial court next held claim 1 of the '982 patent (and its dependent claims) to be indefinite because

the court concluded that claim 1 contains inconsistent requirements regarding the extent to which the catalyst particles had to be fluidized in the reactor column. Fluidization relates to the distribution of catalyst particles in the slurry bubble column. The term "H," as used in the '982 patent, refers to the expanded height of the liquid in the column. '982 patent, col. 7, ll. 52-53 & col. 14, l. 24. The patent refers to the extent of fluidization with reference to the term "H," and the parties disagree about whether the claim contains two fluidization height limitations or only one.

[89] The specification explains that the maximum height to which the catalyst can be fluidized is given by D/(Us - UL), where D is the dispersion coefficient for the catalyst particles, Us is the particle settling velocity, and UL is the liquid velocity along the column. According to the specification, excellent reactor performance can be achieved when the reactor is designed and the operating conditions are selected so that that H = D/(Us - UL). '982 patent, col. 7, ll. 33-53.

[90] The specification further explains that if the dispersion is maintained at a level just sufficient to fluidize the particles, i.e., D (0.5H(Us - UL), then a condition known as "plug flow" will prevail. '982 patent, col. 7, ll. 62-66. Plug flow is described in the specification as a desired property of the claimed invention. The claims of the patent explicitly reference that equation, requiring that the catalyst particles be fluidized according to the formula 0.5(Us - UL) (D/H, where the height of the liquid in the column is greater than three meters.

[91] The trial court interpreted that limitation as requiring fluidization of the catalyst particles to at least the height 0.5H (i.e., according to the formula 0.5H (D/(Us - UL)). The court also found that the patent claims implicitly reference the first equation, requiring "fluidizing the . . . catalyst particles . . . to the height, H > 3m" (i.e., according to the formula H = D/(Us - UL)). According to the trial court's construction, the claim "tells a person with ordinary skill in the art both that the solid particles must be fluidized to the top of the expanded liquid and that the particles may be fluidized to only one-half the height of the expanded liquid." The court therefore concluded that those limitations were fatally inconsistent, and it therefore held the claims indefinite.

[92] We disagree with the trial court's conclusion as to what the claim language requires. The specification discloses two conditions-a "sufficient" fluidization condition described by the equation H (2D/(Us - UL), where the dispersion is just sufficient to fluidize the particles and to achieve plug flow, and an "excellent" fluidization condition described by the equation H = D/(Us - UL), where the dispersion is greater. Although it is not entirely clear from the specification which condition is preferred, the "sufficient" fluidization condition is the only one claimed. The trial court improperly imported the "excellent" fluidization condition into the claims, thereby creating an apparent inconsistency. Because the reference to the fluidization requirement is sufficiently clear that a person of skill in the art would understand the scope of the claim, the claim satisfies paragraph 2 of section 112.

[93] C.

[94] The trial court next held the claim term "particles of average diameter, dp > 5 um" to be indefinite because the term does not set forth any upper limit on particle size. The specification states that "[p]articles with greater than 100 um [100 microns] diameters cannot be effectively fluidized without a backmixing debit on the kinetic driving force." '982 patent, col. 13, ll. 42-45. Although the court properly refused to read that language into the claims, it held that the failure to include such a limitation on particle size in the claims rendered the claims indefinite. That was error. The claims do not contain

any limitation on maximum particle size, and no limitation is required as a matter of definiteness. Thus, the claims expressly reach any composition with catalyst particles having an average diameter greater than five microns, no matter how large the particles may be; as such, there is no indefiniteness as to the scope of that limitation. The government's real objection to the claims as written is that they may include some inoperable embodiments, such as one in which the particles have an average diameter greater than 100 microns. However, that is an issue of enablement, and not indefiniteness. See Miles Labs., 997 F.2d at 875, 27 USPQ2d at 1126 ("The invention's operability may say nothing about a skilled artisan's understanding of the bounds of the claim."); see also Personalized Media Communications, 161 F.3d at 705, 48 USPQ2d at 1888; N. Am. Vaccine, 7 F.3d at 1579, 28 USPQ2d at 1339. A patent claim to a fishing pole would not be invalid on indefiniteness grounds if it contained a limitation requiring that the pole be "at least three feet long," even though a 50-foot-long fishing pole would not be very practical. By the same token, there is nothing indefinite about the claim language at issue in this case simply because it covers some embodiments that may be inoperable.

[95] D.

[96] Finally, the trial court held the term "UL" to be indefinite. UL refers to the liquid velocity along the column. '982 patent, col. 7, ll. 36-37 & col. 14, l. 23. The court held that term to be indefinite on the ground that one of skill in the art could not understand whether the patentee meant to refer to interstitial velocity or superficial velocity. Interstitial velocity accounts for liquid holdup (i.e., internal structures, gas bubbles, and solid particles in the column that reduce the area through which a given volume of fluid flows), and therefore measures the actual or true velocity with which the liquid rises in the column. Superficial velocity refers to the velocity of the liquid without reference to impediments within the column. Interstitial and superficial velocity can vary by as much as 50%. Although the '982 patent does not explicitly define UL in terms of interstitial velocity, Exxon argues that one of skill in the art would recognize that UL must be expressed in terms of the interstitial liquid velocity. Exxon's expert, Dr. Bell, testified that the inequality, 0.5(Us - UL) (D/H, would not make technical sense if UL were expressed in terms of superficial velocity. That is because the other variables all measure conditions in the column: Us is the particle settling velocity in the column, D is the dispersion coefficient for the particles in the column, and H is the height of the expanded liquid in the column. Moreover, UL is subtracted from Us, an operation that would make little sense unless UL were an interstitial velocity. As it is, the expression Us - UL represents the actual speed at which particles settle.

[97] The government counters the testimony of Dr. Bell by pointing to another limitation in the claims relating to the gas velocity along the column, Ug. Although in the trial court the government challenged the term Ug as indefinite on similar grounds, the court found that Ug referred to superficial gas velocity and was therefore not indefinite.

[98] The court based its determination on an example in the specification disclosing an equation in which Ug is divided by the gas holdup, E. '982 patent, col. 10, ll. 30-34. The court noted that one of skill in the art would divide superficial velocity by the holdup in order to calculate interstitial velocity. The trial court therefore concluded that because the specification discloses dividing Ug by E, Ug must be a superficial velocity. The government seizes on that conclusion to impeach Exxon's assertion that UL is an interstitial velocity. The government argues that a person of ordinary skill in the art would read Ug and UL consistently, and thus such a person would conclude that UL may be a superficial velocity.

[99] This is a close question. The patentee could easily have cured the ambiguity by adding a single word or phrase to the claims or specification of the '982 patent stating which method of measuring liquid

velocity the patentee was using. In fact, much of the extrinsic evidence suggests that the practice in this field of art is to state specifically whether velocity is interstitial or superficial. That practice was not followed in the '982 patent, and the result is that there is some question as to the proper interpretation of the claims.

[100] The question we must answer is whether the claims are rendered so ambiguous that one of skill in the art could not reasonably understand their scope. We conclude that one of skill in the art could and would understand that UL refers to the actual or interstitial liquid velocity along the column. That is the more reasonable interpretation of the term UL in light of the other variables describing actual column conditions.

[101] The government's argument that Ug and UL should be read consistently is not without merit. However, that argument cuts both ways. According to the trial court, a person of ordinary skill in the art would interpret Ug as reflecting a superficial velocity, because the specification discloses dividing Ug by the gas holdup. A person of skill in the art faced with the value UL might draw the negative inference that because the specification nowhere discloses dividing UL by the liquid holdup, it is an interstitial velocity.

[102] If this case were before an examiner, the examiner might well be justified in demanding that the applicant more clearly define UL, and thereby remove any degree of ambiguity. However, we are faced with an issued patent that enjoys a presumption of validity. In these circumstances, we conclude that a person of skill in the art would understand the scope of the term UL , and that the degree of ambiguity injected into the claims by the patentee's lack of precision is therefore not fatal.

[103] Because we hold that the terms "substantial absence of slug flow," "fluidizing the . . . catalyst particles . . . to the height, H > 3m," "particles of average diameter," and "UL" are not indefinite, we reverse the Court of Federal Claims' summary judgment of invalidity as to the '982 patent.

[104] Each party shall bear its own costs for this appeal.

[105] REVERSED and REMANDED.

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